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Chapter 13

# Embodiment, process, and product in ensemble expression

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## Introduction

In performing together, musicians create a shared, coordinated performance. Such ensemble performances are established dynamically and interactively, as well as through constructing a distributed notion of the outcomes of performance. An element of emergence and uncertainty will always be present in ensemble performance. Nevertheless, musicians develop ideas about musical aesthetics, style and expression, and an in-depth familiarity with the sounding structures and cohering parts of music, particularly in score-based genres. This chapter will consider this dichotomy between ensemble performance as process and as product, giving priority to the former whilst reconciling the latter. By looking at process and product, it considers tensions between an embodied and enactive perspective on performance emphasizing real-time, distributed interaction between organism and environment, and a more (traditional) cognitive perspective that emphasizes the concepts, ideas, and representations that performers bring, and that inform performance. Perspectives on ensemble performance as embodied and as examples of a complex, dynamic system are finding increased support and traction in research (e.g. Glowinski et al., 2016, see also van der Schyff et al., 2018). This chapter enhances existing research by explicitly addressing how ensemble performance processes that have been primarily investigated from a cognitive perspective can be (better) understood as embodied and enactive. In doing so, it aims to deepen our understanding of expressive communication in ensemble performance, identifying gaps and future directions for research: how do musicians develop a shared performance that they

agree on; how do they coordinate musically; and how may performance processes depend on musical context and ensemble aesthetics?

## Processes of interaction and emergence

This first section discusses the first two questions of how musicians develop a shared performance that they agree on, and what processes inform such musical coordination. Three issues are addressed, namely 1) is there a need for shared cognitive representations of the music, 2) what processes are involved in addition to temporal coordination and how are they enactive and embodied, and 3) in what ways are these processes of coordination communicative and expressive?

### *Cognitive representation vs. emergence and embodiment*

What does it mean to have shared performance goals in an ensemble context? Does it mean that musicians agree, conceptually, on how the music is organized, structured and should sound? In a cognitive interpretation of ensemble performance, one may indeed expect that musicians develop a shared understanding of music and this gives rise to a successful performance. This may function analogously to the generation of expression from a cognitive interpretation of musical structure (Palmer, 1997). However, an embodied and enactive perspective would rather argue that "agreement" is obtained through real-time processes of coordination and synchronization without the need for musicians to agree in cognitive terms (i.e. mentally) on their expressive intentions, conceptualizations and representations of the music, as long as the agreement is realized externally in terms of coordinated sounds and movements. Alignment of expressive intentions may strengthen as a consequence of the

performance process, but they are not necessarily the origin, nor a prerequisite for a successful performance.

Empirical research has shown that familiarity with the parts and style of co-performers benefits successful synchronization (Hadley et al., 2015; Keller et al., 2007), strengthening the ability to predict the timing of the co-performer. Intriguingly such ability to predict is associated with a high empathic personality trait (Novembre et al., 2019). Whilst this suggests an important role for shared mental representations, a more embodied interpretation is possible too: familiarity with the actions or motor-repertoire of the co-performer will enhance synchronization, allowing for motor resonance with those actions, which causally contributes to accurate synchronization (Hadley et al., 2015). Indeed, empathy may have a strong embodied component and rely on motor mimicry (Novembre et al., 2019).

Other evidence for the importance of emergent, embodied action comes from studies that have shown that performers do not necessarily agree on the details of an otherwise coordinated performance and may show diverging interpretations of the music (Schober & Spiro, 2014). Furthermore, when looking at rehearsal behavior of ensembles, including what is talked about and how musical interpretations are developed, processes of agreement and coordination tend to be implicit and established through real-time music-making rather than conceptually agreed in verbal explanation and discussion. For example, Pennill (2019) found in a longitudinal study that musicians spend relatively little time discussing expressive aspects of performance, even though it was seen as an important objective for rehearsal.

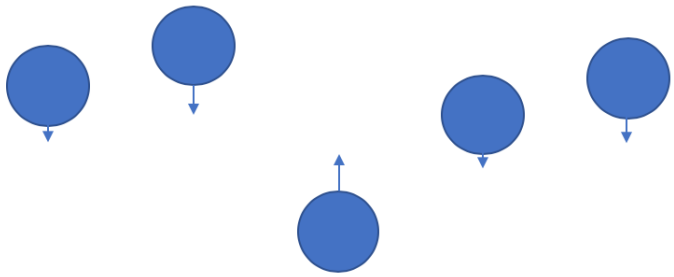
***Processes of alignment between ensemble performers***

Concerning real-time processes of musical coordination, significant research has been dedicated to understanding the way in which performers achieve inter-personal synchronization (see also Chapter 17. Classical models of sensorimotor synchronization allocate a central role to a mental "time-keeper" that generates motor outputs and responds to external events (Repp & Su, 2013). Research on synchronized tapping models processes of synchronization as a combination of prediction (anticipation) of subsequent taps, and adaptation to discrepancies between taps (Keller, 2014). Furthermore, allocation of attention to others and oneself may influence the degree to which one adapts to each other. For example, in a string quartet, performers might adapt more strongly to the first violin than to other performers. In reality, patterns of inter-dependence turn out to be considerably more complex (Timmers et al., 2014; Wing et al., 2014).

Indeed, the complex inter-relationships between performers is a major argument for investigating ensemble performance as a complex dynamic system. Within such a system, entrainment in time is modelled through the use of coupled oscillators, rather than linearly responding timekeepers (Loehr et al., 2011). Despite large differences in conceptualization and theorization, essential aspects of time-keeper models find their counterpart in entrainment models. In non-linear models, oscillators entrain to external stimuli through period resonance and phase coupling (Large & Jones, 1999), which can be seen as analogous to period prediction (anticipation) and phase correction (adaptation) in time-keeping models. Furthermore, the attunement of phase expectancy (precision of prediction) may sharpen or broaden depending on contextual factors such as the degree of periodic regularity of the stimuli, and listeners referent period (spontaneous tempo that is most stably produced) and focal attention ability (Drake et al., 2000). Such sharply or broadly defined attunement of phase expectancy influences coupling strength (Large & Jones, 1999), which can be seen as a

parallel to attention allocation. Intriguing evidence has been found in support of models of oscillatory entrainment in demonstrations of correlations in brain wave periodicities between performers playing together (Sänger et al., 2012), and neurological responses to presented stimuli, including neurological oscillations correlated with periodicities that are implied but not physically present (Tal et al., 2017).

An important characteristic of the coupled-oscillators model is the assumption that different units form part of a larger system that behaves in a complex non-linear manner. To explore how this may work with respect to e.g. tuning, Figure 13.1 shows a potential scenario of the tuning of five singers at a given moment in time, illustrated by five circles that represent the five singers singing at a certain relative pitch height (intonation), represented by their vertical position. If we assume that the relationships in tuning can be conceptualized as a form of pulling and pushing in converging directions (see arrows) as in a connected system, a singer who is more out of tune would encounter greater pull than a singer who is less out of tune compared to the mean tuning. It follows that we may expect adjustments in the direction of the mean rather than strong patterns of coupling between pairs of performers.



<Insert Figure 13.1. Illustration of a pull towards the mean in the tuning of notes by five singers, shown as five circles positioned at different vertical heights representing their relative tuning>

To illustrate that this indeed provides a useful perspective on ensemble tuning, two analyses were conducted of previously collected data of tuning in a vocal quintet singing a brief homophonic piece six times (D'Amario et al., 2020). The tuning of each note of each singer (Singers 1-5, henceforth S1-5) was measured as deviation from equal temperament in cents ("relative tuning"). For the current analysis, only the data of the last rehearsal are examined.[1]

The first analysis assumes that performers adjust to each other in a pair-wise fashion. This is similar to pairwise cross-correlation analyses conducted to examine processes of ensemble synchronization (Timmers et al., 2014). The hypothesis is that pairs of singers adjust to each other in tuning during each note of the music, leading to positive pairwise cross-correlations at "lag 0". Alternatively, singers may realize such adjustments with a lag, leading to positive cross-correlations at e.g. a lag of one note ("lag"). Table 13.1 shows the average of pairwise cross-correlations between singers at lag 0 and 1 (Analysis 1).

The second analysis assumes that the singers work as part of a system as illustrated in Figure 13.1. As mentioned, the hypothesis is that singers will adjust their tuning relative to the degree of deviation from general tuning. Such "general tuning" is estimated as the mean relative tuning across singers. This should lead to negative correlations between adjustments to the next note and deviation from general tuning for each singer. The right columns in Table 13.1 show the average correlations per singer arising from this analysis. It is evident from the table that while Analysis 1 leads to small cross-correlation values, Analysis 2 shows greater adjustments from individuals to the collective to increase in-tune singing.

[1] A complete analysis and explanation will be made available in work that is in preparation

Table 13.1. Overview of pairwise correlations between tuning deviations of singers at lag 0 and lag 1 (analysis 1) and correlations for each singer between adjustments to the next note (difference in relative tuning) and deviation from general tuning (analysis 2). Correlations are averages across 6 performances with 42 notes per performance. Analysis 1 includes several correlations with different singers, and the maximum correlation and mean across those is presented.

| | Analysis 1 | | | | Analysis 2 |
|---|---|---|---|---|---|
| | Lag 0 | | Lag 1 | | |
| | Max | Average | Max | Average | |
| S1 | .054 | .027 | .265 | .073 | -.430 |
| S2 | .140 | .040 | .202 | .045 | -.511 |
| S3 | .071 | .029 | -.017 | -.049 | -.710 |
| S4 | .165 | .103 | .106 | .025 | -.588 |
| S5 | .165 | .033 | .111 | .053 | -.619 |

Although Analysis 2 is a considerable simplification of the complex systems perspective, the findings provide an indication of the relative power of the perspective of considering the ensemble as a system, rather than looking at interactions between individual agents who respond individually to each other. It will be of interest to apply this perspective in future research to timing and dynamics as well as tuning.

***Sonic and bodily alignment as expressive communication***

Having discussed processes contributing to the emergence of shared performances, we may wonder in what ways such a shared performance can be said to be expressive or

communicative. Performance expression has traditionally been defined as referring to "the large and small variations in timing, intensity or dynamics, timbre, and pitch that form the microstructure of a performance and differentiate it from another performance of the same music" (Palmer, 1997, p. 118). Additionally, it has generally been understood that expressive variations serve the purpose of communicating a performer's interpretation of the structure, emotion and character of the music (Palmer, 1997; Timmers, 2007). Offering a useful alternative, Ashley (2017) argued for the definition of communication as "action intended to bring about alignment or coordination of states between individuals" (p.479). If states are sounds and behaviors of ensemble performance, we can interpret much of what musicians do as communicative: synchronization, blending, harmonizing, interlocking in time, but also coordination of bowing, breathing, gesturing, and looking. Nevertheless, we can additionally argue that the produced sounds and gestures may be expressive and carry referential meaning. It is noteworthy that in ensemble performance research, the emphasis has been on "coming together" rather than on deviating from the expected, as is central to the interpretation of "expression" in solo performance. The suggestion here seems to be that variations in tempo, dynamics, timbre and tuning may emerge through performance, but a primary ensemble task is to do this jointly and to stay together. Nevertheless, realizing change at various moments in the music is a central aspect of ensemble performance and rehearsal. Processes to realize change may be different from what we have focused on so far. Change may require more of an intentional effort, such as a deliberate acting on cues in the score (such as sf or fff), cues from co-performers (looks or gestures) or verbal agreements.

With respect to possible referential meaning of ensemble sounds, we can argue that "embodied meanings" may specifically concern associations with energy levels, bodily tension and effort, sensations, feelings, and emotions, but also associations with movement

patterns, gestures, actions, and interactions. However, embodied meaning also relates to contextual embedding, i.e. sounds become meaningful through sense-making interaction (Schiavio et al., 2017). As such, they may for example be experienced as religious, celebratory, motivational, or relaxing. Furthermore, we may act on sounds through drawing associations with other musical and non-musical sounds, both from within the music that is performed and beyond (Clarke et al., 2016).

**Product concepts of ensemble performance**

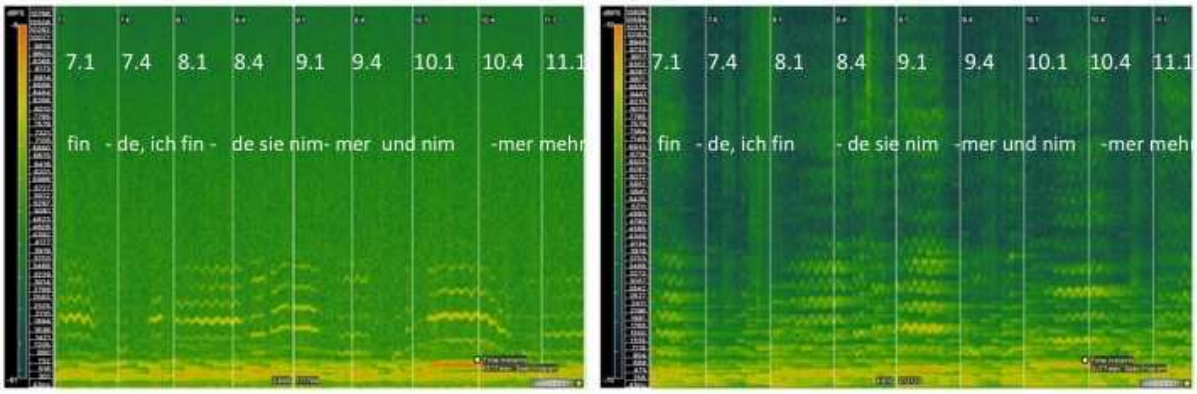
This last section considers conventions and aesthetic preferences related to ensemble performance that may shape and inform *the product* of performance practice. A growing body of research has documented the changes over time in practices and aesthetic concepts related to performance style. Developing from pioneering research by Philip (1992) among others, historical recordings provide evidence of changing performance practices (see also Chapter 22). Changes in performance style within western classical performance traditions include the type and amount of tempo rubato, the employment of vibrato in singers, strings and wind players, tempo choices, the use of dynamics, and the employment of portamento. Developments with respect to tuning preferences have been suggested too, although they are hard to reliably quantify (Devaney & Ellis, 2008). Various factors may lie behind changes in performance style, whether this concerns a possible push towards "objective perfection" driven by recording conditions or revivals of historical performance practices (see e.g. Day, 2000; Fabian, 2015). What is of relevance here is that many developments in performance style concern the ensemble as much as the individual performer.

For an illustration, consider Figure 13.2 which shows spectrograms of an excerpt of Schubert's "Gretchen am Spinnrade" performed by Emma Eames and Henri Gilles in 1911[2] (left panel) and by Gundula Janowitz and Irwin Gage in 1977[3] (right panel). The visible panel relates to measures 7-11. The two performances are highly contrasting in tempo (73[4] vs 57 BPM), in the use of vibrato and portamento by the singers, and in tempo rubato (see Timmers, 2007). Moreover, a marked contrast can be observed between the temporal alignment of the voice and accompaniment. In the performance from 1977, the voice and accompaniment are strongly vertically aligned: the voice makes rapid note transitions assuring that new pitch onsets coincide with the accompaniment (half measure onsets in the accompaniment are marked by vertical lines). Fluidity is present in dynamics (becoming softer at note endings) and vibrato (e.g. starting late with vibrato). In comparison, the relationship between voice and accompaniment is more flexible in the 1911 recording (left panel), where the voice regularly anticipates note transitions by leaving a note early and gradually descending (measures 7.1, 9.1, 10.4) or ascending into the next note (end of 8.4), and modifying alignment by early (9.4) or delayed timing (8.4). Such fluid relationships between accompaniment and melody have been observed in various genres, including jazz (Ashley, 2002) and popular music (Dibben, 2014). Hudson (1994) referred to this as tempo rubato in which time is "stolen" and subsequently "paid back" to restore alignment. This contrasts with the second type of tempo rubato in which vertical alignment is continuously maintained between voices that together vary gradually in tempo.

[2] Available at https://www.youtube.com/watch?v=y3q70UZsGbE, excerpt: 11-19 seconds. From *The Record of Singing I.* EMI RLS 724.

[3] Available at https://www.youtube.com/watch?v=B0w0n7IOogA, excerpt: 14-24 seconds. From *Schubert Lieder.* Deutsche Grammophon 453 082-2.

[4] The absolute tempo of historical recordings is hard to know for sure, as playback speed may have been adjusted by editors in the digitisation of the recording.




<Insert Figure 13.2. Spectrogram with timepoints indicating measure and half-measure onsets in the accompaniment. Left: Emma Eames, 1911; Right: Gundula Janowitz, 1977>

Fluid vertical relationships between voices seem to pose a challenge to models of ensemble synchronization, in particular when interpreted from the perspective of noise-like deviation from a stable timekeeper. Interpreting synchronization as coupling within a complex system may offer a more flexible perspective. As Clayton (2012) explains, entrainment in phase and frequency may occur between systems with a great variety of characteristics, and the degree of coupling may vary. Coupling may occur between phases that are not strictly aligned such as anti-phase coupling or if one voice is performing ahead of another and entrainment may be induced with attractor ratios other than 1:1, 2:1 or 3:1. Interestingly, whilst entrainment may occur between non-periodic systems, periodicity is a strong feature of human movement. As Will et al. (2015) demonstrated, even in the absence of a clear musical pulse, for example in the *alap*, a rhythmically free improvised section of a raga, listeners refer to an inner pulse to tap along with the music, and align their taps with recurring temporal patterns in the music. Indeed, a pulse is often physically present in movement to support performances of an *alap* (Will et al., 2015).

What these examples demonstrate is the diversity of forms of entrainment in musical ensembles (see also Chapter 17, 22), whether this concerns entrainment with uneven temporal proportions such as in performances of Balkan *aksak* rhythms (Clayton, 2015) or entrainment with rhythmically free musical improvisation. The role of movement coordination in such entrainment is of particular interest. For example, relatively independent voices may be entrained to by different motor effectors that are nevertheless experienced as coordinated, as when one taps a foot and gestures along to represent the (fluid) entrainment of the vocal line.

For ensemble performance, these differences in how parts align imply different styles of coordination, representing differences in ensemble aesthetics. Similarly, ensemble aesthetics may relate to ways in which ensembles blend harmonically and in terms of tuning. Experimental investigation has shown differences in synchronization for homophonic or polyphonic music (D'Amario et al., 2020). It will be of interest to extend these investigations to other performance dimensions and to consider the processes of coordination and their aesthetic implications. Perceptual studies that use different versions of musical coordination may be helpful in characterizing such aesthetic principles. For example, Marandola (2014) studied criteria regulating the "acceptability" of the interrelationships between voices in a Pygmy community. On the other hand, learning to physically entrain to an unknown genre may help one to learn some of that genre's aesthetic principles.

**Conclusion: Ensemble performance as a complex system**

Ensemble performance is a prime example of complex behavior in which performers are coupled through sound and movement, making up a larger whole. Individual components

may adjust locally to maintain equilibrium of the system, while simultaneously the system develops over time. The power of this perspective is that it allows for continuous, flexible adjustments and explains why there is no need for a fully-fledged agreed representation of the ensemble, which is unlikely to happen. Performance develops in the moment, and is relative to what immediately preceded it. Nevertheless, forms of interaction and outcomes of performance are subject to changes related to performance style and ensemble aesthetics. Familiarity with other performers' parts and style of performance facilitates entrainment and may strengthen the coupling. Within this complex dynamic, performers have agency to influence and shape the ensemble, both in terms of process and product. Through explicit and implicit communication, performers may introduce and develop innovative ensemble aesthetics. From an embodied perspective, ensemble aesthetics can be understood as related to the type of interrelationships between performers, and the movements, shapes and textures associated with ensemble sounds. Performers' movements and playing techniques may be important drivers in the establishment of novel ensemble aesthetics. Indeed, innovation in music performance inevitably requires, through its embodied nature, action innovation.

Continuing the research, it will be of interest to investigate coupling processes in time, intensity and intonation across different genres and styles: what types of discrepancy or "asynchronization" are minimized, or, more positively, what opportunities for unity and interdependence are explored/exploited? Similarly, it will be of interest to explore stylistic components of ensemble aesthetics: what makes up the repertoire of actions, sounds, and interrelations of an ensemble and which are identifiers for the ensemble as a whole? Other researchers have also interpreted ensemble performance as a complex system, have investigated expressiveness from an embodied perspective, and have pointed out the distributed and emergent characteristics of creative music making (e.g. Clarke & Doffman,

2017, see also Fabian, 2015). The contribution of this chapter is to explicitly connect notions of expressive ensemble performance with processes of ensemble coordination and communication; to explore where embodied perspectives connect with and deviate from more traditional, cognitive perspectives; to move beyond a focus on timing and consider adaptive processes in intonation; and to balance perspectives on performance as process and as product.

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