

Endocrine

See Hormones

Ensemble Performance

An ensemble is a group of performers who pursue a joint musical goal through collective action. The term *ensemble* is also applicable to dance groups. Ensemble performance is an ancient form of human expression. The discovery of multiple flutes and whistles at several archaeological sites hints at the existence of instrumental ensembles in Upper Paleolithic times (possibly more than 40,000 years ago), with vocal and percussive ensemble performance presumably predating these early forms of joint music making.

Musical ensembles vary in terms of their composition and function. The composition of an ensemble refers to the number of performers, their roles within the group, and the types of instrumental forces that are employed. An ensemble's function is a matter of its role in the broader social fabric of a particular culture. Artistic ensemble performance generally entails individuals coordinating their sounds and body movements in order to communicate information about musical structure and expressive intentions to co-performers and audience members. When considered as a microcosm of human interaction, ensemble performance is a fruitful domain in which to study the social factors and psychological mechanisms that shape the dynamics of interpersonal coordination.

Types of Ensemble

While the minimum number of performers in an ensemble is two, the maximum number is open-ended and constrained only by the requirement that co-performers must be in contact with one another in order to coordinate their actions in real time. Typically, this means that ensemble musicians assemble in the same performance space. However, there are exceptions (such as a piece by Karlheinz Stockhausen that requires video- and audio-linked members of a string quartet to play while hovering in four separate helicopters), and

nowadays ensemble performance spanning distant locales is possible via the Internet.

Ensembles may comprise multiple performers playing the same type of instrument (e.g., the piano duo or ukulele orchestra), instruments from the same family (e.g., string quartet or vocal choir), or mixed ensembles with standard combinations of instruments from different families (e.g., symphony orchestra or jazz big band) or novel combinations prescribed by the composer (e.g., Leoš Janáček's *Capriccio* calls for piano left hand, flute, two trumpets, three trombones, and tenor tuba). Small ensembles usually require each part in the musical texture to be played by a single performer, while larger ensembles may require multiple individuals to play the same part (as in an orchestral string section).

The possible combinations of instruments in mixed ensembles are virtually limitless, but certain combinations have enjoyed longevity. Examples include myriad duos (solo instrument or voice accompanied by piano), as well as trios, quartets, and quintets incorporating various combinations of piano, string, and wind instruments in Western chamber music; groups with vocals, guitar, keyboard, bass, and drum kit in Western popular music; jazz combos with solo brass and wind instruments accompanied by a rhythm section (bass and drums); Balinese gamelan; African drum and xylophone ensembles; and Indian sitar and tabla partnerships.

Ensembles that have become standard within a musical genre have done so because they are optimally suited to serve a given function. Such ensembles thus provide the appropriate palette of sounds for composers to express themselves, they are capable of producing sounds that induce certain mental states (excitement, ecstasy, awe, reverence, and transcendence) in the context of festivals and rituals, and they satisfy practical considerations in terms of sound intensity and mode of performance (e.g., marching bands require large numbers of loud instruments that can be played outdoors while the performers are mobile). Ensembles that perform in the context of dramatic art forms, such as musical theater and opera, must likewise satisfy a mixture of practical and aesthetic constraints.

Each performer's part in an ensemble contributes to the aggregate musical texture by fulfilling

a specific role. Homophonic musical textures are characterized by clear hierarchical relations between melody and accompaniment or by mutual complementarity between parts, such as when voices blend in a chorale. In polyphonic textures, instrumental parts are ostensibly independent but equal and may take turns at looming into the limelight. Ensemble performance, especially in small groups such as chamber ensembles, is often described as analogous to a conversation between individuals. This analogy may be particularly apt in the case of improvised music, where co-performer interaction entails the spontaneous invention of musical material.

The roles played by separate parts in an ensemble texture influence how leadership is distributed among co-performers. Thus, depending on the structure of the music and conventions concerning how it should be performed, leadership—in the sense of who sets the tempo and cues group entries—may be fixed during the performance or it may shift between individuals. Leadership in the broader sense of shaping the artistic interpretation of a piece is determined by pragmatic considerations concerning the optimization of musical decision making. Different models of ensemble leadership exist, ranging from egalitarian piano duos, through democratic mixed chamber groups, to autocratic regimes where a conductor is expected to impregnate an entire orchestra with his or her musical ideas.

A conductor is typically used in large ensembles such as symphony orchestras. The conductor's role is to lead the orchestra by providing hand (and baton) movements, body gestures, and facial expressions that function dually to provide cues concerning the goal interpretation of the work—which is typically communicated during rehearsal—and to assist the ensemble members in achieving coordination in terms of basic timing and musical expression. Usually only a single conductor is required, though works have been written for multiple orchestras led by multiple conductors (e.g., Charles Ives's *Fourth Symphony* and Stockhausen's *Gruppen*).

Chamber orchestras often do not use a conductor and instead are led by a member of the ensemble, such as a violinist or keyboard player (as in the Australian Chamber Orchestra and the Australian Brandenburg Orchestra), or by a

core group of principal players (as in the Orpheus Chamber Orchestra). Large orchestras seldom dispense with the conductor, though the Persimfans conductorless orchestra (originally operational from 1922 to 1932 in the Soviet Union) is a notable exception that eschewed conductors on ideological grounds. Sergei Prokofiev had high praise for the Persimfans orchestra—whose members each had to acquire familiarity with the entire score and then to play in circular formation—though he noted the difficulty presented by tempo changes.

Some small to intermediate-sized ensembles employ a “rhythm section” to solve the problem of keeping in time. This device is common in ensembles that practice pulse-based (as opposed to “free”) forms of improvisation. In modern popular music (e.g., jazz, rock, and pop), instruments such as the bass guitar and drums provide a pulse relative to which rhythms produced by other instruments are timed. The *basso continuo* (a bass line performed by a keyboard instrument, often supported by another low-pitched instrument) served a similar function in 16th and 17th century baroque music. In several varieties of gamelan, the small *kempli* gong articulates the pulse and thereby aids in coordinating the interlocking parts played on other instruments. Ancient precursors of ensemble performance may have involved joint vocalizations accompanied by rhythmic percussion sounds produced during communal work activities such as making stone tools and pounding grain.

The Psychology of Ensemble Performance

Musical ensemble performance is a social art form that places exceptional demands upon the mental and physical capacities of co-performers. A particularly remarkable feature of ensemble performance is the balance that individuals are able to achieve between temporal precision and flexibility in interpersonal coordination. Such coordination is typically a highly creative affair involving different body parts, complementary roles played by different individuals, and the need to accommodate changing cognitive, motor, affective, and social demands during performance. Yet, competent co-performers are able to synchronize their actions to within several tens of milliseconds. Empirical research on ensemble performance has



Kapelle#3 performs at the Barinton Live Music Club in Cologne, Germany, February 19, 2012. The lively ensemble features ska and reggae music, pumping rhythms, and horn arrangements. Artistic ensemble performance entails individuals coordinating sounds and body movements to communicate information about musical structure and expressive intentions to co-performers and audience members.

addressed how the ability to do so is influenced by strategies that are used to prepare for performance, psychological mechanisms that underpin interpersonal coordination during performance, and intrinsic (personal) and extrinsic (contextual) factors that affect the implementation of these strategies and mechanisms.

Musicians in many ensemble traditions prepare for performance through a combination of individual private practice and collaborative group rehearsal. Collaborative rehearsal is typically aimed at establishing a shared performance goal, that is, a unified conception of the ideal integrated ensemble sound. Shared performance goals are generally premeditated and fixed in scripted music but arise spontaneously and transiently in improvised music. Shared goals are strategically pursued during rehearsal through a process by which ensemble musicians become familiar with each other's parts and the manner in which these

parts will be played. This process primarily entails nonverbal communication through body movements and musical sounds, though some amount of verbal communication does take place.

Ensemble cohesion is predicated upon the musicians reaching a consensus on how expressive performance parameters, including timing, intensity, articulation, and intonation, should be modulated in order to communicate the goal interpretation of a piece. A mixture of social, conventional, and pragmatic considerations govern this process of negotiation. Social factors—including personality, preexisting interpersonal relationships, verbal and nonverbal communication styles, and gender and instrument stereotypes—can impact the effectiveness of information exchange during rehearsal. In professional ensembles, this impact is moderated by conventions concerning matters of organization, administration, repertoire choice, and musical interpretation. Practical issues such as the size

of the group can nevertheless affect negotiations by influencing leadership and decision making.

Once shared performance goals are consolidated, they reside in each individual's memory as idealized mental representations of the sounds constituting a musical piece. With such goals in mind, musicians develop performance plans that guide the motor processes involved in translating the goal representations into body movements that are appropriate for generating the ideal sound. To link individual performance plans into a common scheme that can be used to regulate the interplay between co-performers, ensemble musicians develop systems of shared performance cues (i.e., features of the music that group members collectively attend to during performance).

The successful execution of shared goals and plans during ensemble performance is facilitated by cognitive and motor skills that enable co-performers to anticipate, attend, and adapt to each other's actions in real time. These skills allow performers to communicate their intentions concerning musical structure and stylistic expression via the auditory modality (through variations in timing, intensity, intonation, articulation, and timbre) and the visual modality (through gestures, eye gaze, and large-scale movements such as body sway). The degree to which mutual anticipation, attention, and adaptation are required varies as a function of the type of ensemble (e.g., small chamber group versus large symphony orchestra) and momentary demands of the music (e.g., steady versus changing tempo).

The requirement to align performance parameters related to basic and expressive properties of sounds across ensemble members means that musicians may produce the same phrase differently depending on whether it is played solo or in an ensemble. In ensemble playing, performers employ behavioral modifications that simplify interpersonal coordination by making actions easier to predict, for example, by using less *rubato* or by exaggerating their body movements. Highly refined ensemble skills and strategies thus enable co-performers to transcend their individual musical identities to achieve a group identity and an inherently social form of expression.

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See Also: Marching Bands; Movement; Music Collectives; Performance; Rituals; School Bands and Choirs; Sociology of Music; Synchronization; Theater; Timing; Whistled Speech.

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Entrainment

Entrainment refers to the interpersonal coordination that is observed when individuals move together in time or share a mutual affective state. Music provides rich opportunities for both temporal and affective entrainment, as can be seen in the sophisticated coordination between members of a music or dance ensemble. Even passive

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