

= Tone cluster =

A tone cluster is a musical chord comprising at least three adjacent tones in a scale . Prototypical tone clusters are based on the chromatic scale and are separated by semitones . For instance , three adjacent piano keys ( such as C , C ♯ , and D ) struck simultaneously produce a tone cluster . Variants of the tone cluster include chords comprising adjacent tones separated diatonically , pentatonically , or microtonally . On the piano , such clusters often involve the simultaneous striking of neighboring white or black keys .

The early years of the twentieth century saw tone clusters elevated to central roles in pioneering works by ragtime artists Jelly Roll Morton and Scott Joplin . In the 1910s , two classical avant-gardists , composer and pianists Leo Ornstein and Henry Cowell , were recognized as making the first extensive explorations of the tone cluster . During the same period , Charles Ives employed them in several compositions that were not publicly performed until the late 1920s or 1930s . Composers such as Béla Bartók and , later , Lou Harrison and Karlheinz Stockhausen became proponents of the tone cluster , which feature in the work of many twentieth- and twenty-first-century classical composers . Tone clusters play a significant role , as well , in the work of free jazz musicians such as Cecil Taylor and Matthew Shipp .

In most Western music , tone clusters tend to be heard as dissonant . Clusters may be performed with almost any individual instrument on which three or more notes can be played simultaneously , as well as by most groups of instruments or voices . Keyboard instruments are particularly suited to the performance of tone clusters because it is relatively easy to play multiple notes in unison on them .

= = Music theory and classification = =

Prototypical tone clusters are chords of three or more adjacent notes on a chromatic scale , that is , three or more adjacent pitches each separated by only a semitone . Three-note stacks based on diatonic and pentatonic scales are also , strictly speaking , tone clusters . However , these stacks involve intervals between notes greater than the half-note gaps of the chromatic kind . This can readily be seen on a keyboard , where the pitch of each key is separated from the next by one semitone ( visualizing the black keys as extending to the edge of the keyboard ) : Diatonic scales conventionally played on the white keys contain only two semitone intervals ; the rest are full tones . In Western musical traditions , pentatonic scales conventionally played on the black keys are built entirely from intervals larger than a semitone . Commentators thus tend to identify diatonic and pentatonic stacks as " tone clusters " only when they consist of four or more successive notes in the scale . In standard Western classical music practice , all tone clusters are classifiable as secundal chords that is , they are constructed from minor seconds ( intervals of one semitone ) , major seconds ( intervals of two semitones ) , or , in the case of certain pentatonic clusters , augmented seconds ( intervals of three semitones ) . Stacks of adjacent microtonal pitches also constitute tone clusters .

In tone clusters , the notes are sounded fully and in unison , distinguishing them from ornamented figures involving acciaccaturas and the like . Their effect also tends to be different : where ornamentation is used to draw attention to the harmony or the relationship between harmony and melody , tone clusters are for the most part employed as independent sounds . While , by definition , the notes that form a cluster must sound at the same time , there is no requirement that they must all begin sounding at the same moment . For example , in R. Murray Schafer 's choral *Epitaph for Moonlight* ( 1968 ) , a tone cluster is constructed by dividing each choir section ( soprano / alto / tenor / bass ) into four parts . Each of the sixteen parts enters separately , humming a note one semitone lower than the note hummed by the previous part , until all sixteen are contributing to the cluster .

Tone clusters have generally been thought of as dissonant musical textures , and even defined as such . As noted by Alan Belkin , however , instrumental timbre can have a significant impact on their effect : " Clusters are quite aggressive on the organ , but soften enormously when played by strings

( possibly because slight , continuous fluctuations of pitch in the latter provide some inner mobility ) . " In his first published work on the topic , Henry Cowell observed that a tone cluster is " more pleasing " and " acceptable to the ear if its outer limits form a consonant interval . " Cowell explains , " the natural spacing of so @-@ called dissonances is as seconds , as in the overtone series , rather than sevenths and ninths .... Groups spaced in seconds may be made to sound euphonious , particularly if played in conjunction with fundamental chord notes taken from lower in the same overtone series . Blends them together and explains them to the ear . " Tone clusters have also been considered noise . As Mauricio Kagel says , " clusters have generally been used as a kind of anti @-@ harmony , as a transition between sound and noise . " Tone clusters thus also lend themselves to use in a percussive manner . Historically , they were sometimes discussed with a hint of disdain . One 1969 textbook defines the tone cluster as " an extra @-@ harmonic clump of notes . "

= = Notation and execution = =

In his 1917 piece *The Tides of Manaunaun* , Cowell introduced a new notation for tone clusters on the piano and other keyboard instruments . In this notation , only the top and bottom notes of a cluster , connected by a single line or a pair of lines , are represented . This developed into the solid @-@ bar style seen in the image on the right . Here , the first chord ? stretching two octaves from D2 to D4 ? is a diatonic ( so @-@ called white @-@ note ) cluster , indicated by the natural sign below the staff . The second is a pentatonic ( so @-@ called black @-@ note ) cluster , indicated by the flat sign ; a sharp sign would be required if the notes showing the limit of the cluster were spelled as sharps . A chromatic cluster ? black and white keys together ? is shown in this method by a solid bar with no sign at all . In scoring the large , dense clusters of the solo organ work *Volumina* in the early 1960s , György Ligeti , using graphical notation , blocked in whole sections of the keyboard .

The performance of keyboard tone clusters is widely considered an " extended technique " ? large clusters require unusual playing methods often involving the fist , the flat of the hand , or the forearm . Thelonious Monk and Karlheinz Stockhausen each performed clusters with their elbows ; Stockhausen developed a method for playing cluster glissandi with special gloves . Don Pullen would play moving clusters by rolling the backs of his hands over the keyboard . Boards of various dimension are sometimes employed , as in the *Concord Sonata* ( ca . 1904 ? 19 ) of Charles Ives ; they can be weighted down to execute clusters of long duration . Several of Lou Harrison 's scores call for the use of an " octave bar " , crafted to facilitate high @-@ speed keyboard cluster performance . Designed by Harrison with his partner William Colvig , the octave bar is

a flat wooden device approximately two inches high with a grip on top and sponge rubber on the bottom , with which the player strikes the keys . Its length spans an octave on a grand piano . The sponge rubber bottom is sculpted so that its ends are slightly lower than its center , making the outer tones of the octave sound with greater force than the intermediary pitches . The pianist can thus rush headlong through fearfully rapid passages , precisely spanning an octave at each blow .

= = Use in Western music = =

= = = Before the 1900s = = =

The earliest example of tone clusters in a Western music composition thus far identified is in the *Allegro* movement of Heinrich Biber 's *Battalia à 10* ( 1673 ) for string ensemble , which calls for several diatonic clusters . An orchestral diatonic cluster occurs also in the representation of chaos in the opening of Jean @-@ Féry Rebel 's 1737 ? 38 ballet *Les Elémens* . From the next century @-@ and @-@ a @-@ half , only a few more examples have been identified , none calling for more than a fleeting instance of the form . These are mostly in French programmatic compositions for the harpsichord or piano that represent cannon fire with clusters , for example in works by François Dandrieu ( *Les Caractères de la guerre* , 1724 ) , Michel Corrette ( *La Victoire d'un combat naval* ,

remportée par une frégate contre plusieurs corsaires réunis , 1780 ) , Claude @-@ Bénigne Balbastre ( March des Marseillois , 1793 ) , Pierre Antoine César ( La Bataille de Gemmap , ou la prise de Mons , ca . 1794 ) , Bernard Viguerie ( La Bataille de Maringo , pièce militaire et historique , for piano trio , 1800 ) , and Jacques @-@ Marie Beauvarlet @-@ Charpentier ( Bataille d 'Austerlitz , 1805 ) .

The next known compositions after Charpentier 's to feature tone clusters are Charles @-@ Valentin Alkan 's " Une fusée " ( A Rocket ) Op. 55 , published in 1859 , and his " Les Diablotins " ( The Imps ) , a miniature from the set of 49 Esquisses ( sketches ) for solo piano , published in 1861 . There is also the solo piano piece Battle of Manassas , written in 1861 by " Blind Tom " Bethune and published in 1866 . The score instructs the pianist to represent cannon fire at various points by striking " with the flat of the hand , as many notes as possible , and with as much force as possible , at the bass of the piano . " In 1887 , Giuseppe Verdi became the first notable composer in the Western tradition to write an unmistakable chromatic cluster : the storm music with which Otello opens includes an organ cluster ( C , C ? , D ) that also has the longest notated duration of any scored musical texture known . Still , it was not before the second decade of the twentieth century that tone clusters assumed a recognized place in Western classical music practice .

= = = In classical music of the early 1900s = = =

" Around 1910 , " Harold C. Schoenberg writes , " Percy Grainger was causing a stir by the near ? tone clusters in such works as his Gumsuckers March . " In 1911 , what appears to be the first published classical composition to thoroughly integrate true tone clusters was issued : Tintamarre ( The Clangor of Bells ) , by Canadian composer J. Humfrey Anger ( 1862 ? 1913 ) .

Within a few years , the radical composer @-@ pianist Leo Ornstein became one of the most famous figures in classical music on both sides of the Atlantic for his performances of cutting @-@ edge work . In 1914 , Ornstein debuted several of his own solo piano compositions : Wild Men 's Dance ( aka Danse Sauvage ; ca . 1913 ? 14 ) , Impressions of the Thames ( ca . 1913 ? 14 ) , and Impressions of Notre Dame ( ca . 1913 ? 14 ) were the first works to explore the tone cluster in depth ever heard by a substantial audience . Wild Men 's Dance , in particular , was constructed almost entirely out of clusters ( listen ) . In 1918 , critic Charles L. Buchanan described Ornstein 's innovation : " [ He ] gives us masses of shrill , hard dissonances , chords consisting of anywhere from eight to a dozen notes made up of half tones heaped one upon another . "

Clusters were also beginning to appear in more pieces by European composers . Isaac Albéniz 's use of them in Iberia ( 1905 ? 8 ) may have influenced Gabriel Fauré 's subsequent piano writing . Joseph Horowitz has suggested that the " dissonant star clusters " in its third and fourth books were particularly compelling to Olivier Messiaen , who called Iberia " the wonder of the piano . " The Thomas de Hartmann score for Wassily Kandinsky 's stage show The Yellow Sound ( 1909 ) employs a chromatic cluster at two climactic points . Alban Berg 's Four Pieces for clarinet and piano ( 1913 ) calls for clusters along with other avant @-@ garde keyboard techniques . Claude Debussy 's 1915 arrangement for solo piano of his Six Epigraphes Antiques ( 1914 ) , originally a set of piano duets , includes tone clusters in the fifth piece , Pour l 'Egyptienne . Richard Strauss 's An Alpine Symphony ( 1915 ) " starts and ends with the setting sun ? a B flat minor chord cluster slowly built down . "

Though much of his work was made public only years later , Charles Ives had been exploring the possibilities of the tone cluster ? which he referred to as the " group chord " ? for some time . In 1906 ? 7 , Ives composed his first mature piece to extensively feature tone clusters , Scherzo : Over the Pavements . Orchestrated for a nine @-@ piece ensemble , it includes both black- and white @-@ note clusters for the piano . Revised in 1913 , it would not be recorded and published until the 1950s and would have to wait until 1963 to receive its first public performance . During the same period that Ornstein was introducing tone clusters to the concert stage , Ives was developing a piece with what would become the most famous set of clusters : in the second movement , " Hawthorne , " of the Concord Sonata ( ca . 1904 ? 15 , publ . 1920 , prem . 1928 , rev. 1947 ) , mammoth piano chords require a wooden bar almost fifteen inches long to play . The gentle clusters produced by the

felt- or flannel @-@ covered bar represent the sound of far @-@ off church bells ( listen ) . Later in the movement , there are a series of five @-@ note diatonic clusters for the right hand . In his notes to the score , Ives indicates that " these group @-@ chords ... may , if the player feels like it , be hit with the clenched fist . " Between 1911 and 1913 , Ives also wrote ensemble pieces with tone clusters such as his Second String Quartet and the orchestral Decoration Day and Fourth of July , though none of these would be publicly performed before the 1930s .

= = = In the work of Henry Cowell = = =

In June 1913 , a sixteen @-@ year @-@ old Californian with no formal musical training wrote a solo piano piece , Adventures in Harmony , employing " primitive tone clusters . " Henry Cowell would soon emerge as the seminal figure in promoting the cluster harmonic technique . Ornstein abandoned the concert stage in the early 1920s and , anyway , clusters had served him as practical harmonic devices , not as part of a larger theoretical mission . In the case of Ives , clusters comprised a relatively small part of his compositional output , much of which went unheard for years . For the intellectually ambitious Cowell ? who heard Ornstein perform in New York in 1916 ? clusters were crucial to the future of music . He set out to explore their " overall , cumulative , and often programmatic effects . "

Dynamic Motion ( 1916 ) for solo piano , written when Cowell was nineteen , has been described as " probably the first piece anywhere using secundal chords independently for musical extension and variation . " Though that is not quite accurate , it does appear to be the first piece to employ chromatic clusters in such a manner . A solo piano piece Cowell wrote the following year , The Tides of Manaunaun ( 1917 ) , would prove to be his most popular work and the composition most responsible for establishing the tone cluster as a significant element in Western classical music ( listen ) . ( Cowell 's early piano works are often erroneously dated ; in the two cases above , as 1914 and 1912 , respectively . ) Assumed by some to involve an essentially random ? or , more kindly , aleatoric ? pianistic approach , Cowell would explain that precision is required in the writing and performance of tone clusters no less than with any other musical feature :

Tone clusters ... on the piano [ are ] whole scales of tones used as chords , or at least three contiguous tones along a scale being used as a chord . And , at times , if these chords exceed the number of tones that you have fingers on your hand , it may be necessary to play these either with the flat of the hand or sometimes with the full forearm . This is not done from the standpoint of trying to devise a new piano technique , although it actually amounts to that , but rather because this is the only practicable method of playing such large chords . It should be obvious that these chords are exact and that one practices diligently in order to play them with the desired tone quality and to have them absolutely precise in nature .

Historian and critic Kyle Gann describes the broad range of ways in which Cowell constructed ( and thus performed ) his clusters and used them as musical textures , " sometimes with a top note brought out melodically , sometimes accompanying a left @-@ hand melody in parallel . "

Beginning in 1921 , with an article serialized in The Freeman , an Irish cultural journal , Cowell popularized the term tone cluster . While he did not coin the phrase , as is often claimed , he appears to have been the first to use it with its current meaning . During the 1920s and 1930s , Cowell toured widely through North America and Europe , playing his own experimental works , many built around tone clusters . In addition to The Tides of Manaunaun , Dynamic Motion , and its five " encores " ? What 's This ( 1917 ) , Amiable Conversation ( 1917 ) , Advertisement ( 1917 ) , Antinomy ( 1917 , rev. 1959 ; frequently misspelled " Antimony " ) , and Time Table ( 1917 ) ? these include The Voice of Lir ( 1920 ) , Exultation ( 1921 ) , The Harp of Life ( 1924 ) , Snows of Fujiyama ( 1924 ) , Lilt of the Reel ( 1930 ) , and Deep Color ( 1938 ) . Tiger ( 1930 ) has a chord of 53 notes , probably the largest ever written for a single instrument until 1969 . Along with Ives , Cowell wrote some of the first large @-@ ensemble pieces to make extensive use of clusters . The Birth of Motion ( ca . 1920 ) , his earliest such effort , combines orchestral clusters with glissando . " Tone Cluster , " the second movement of Cowell 's Concerto for Piano and Orchestra ( 1928 , prem . 1978 ) , employs a wide variety of clusters for the piano and each instrumental group ( listen ) . From a

quarter @-@ century later , his Symphony No. 11 ( 1953 ) features a sliding chromatic cluster played by muted violins .

In his theoretical work *New Musical Resources* ( 1930 ) , a major influence on the classical avant @-@ garde for many decades , Cowell argued that clusters should not be employed simply for color :

In harmony it is often better for the sake of consistency to maintain a whole succession of clusters , once they are begun ; since one alone , or even two , may be heard as a mere effect , rather than as an independent and significant procedure , carried with musical logic to its inevitable conclusion .

= = = In later classical music = = =

In 1922 , composer Dane Rudhyar , a friend of Cowell 's , declared approvingly that the development of the tone cluster " imperilled [ the ] existence " of " the musical unit , the note . " While that threat was not to be realized , clusters began to appear in the works of a growing number of composers . Already , Aaron Copland had written his *Three Moods* ( aka *Trois Esquisses* ; 1920 ? 21 ) for piano ? its name an apparent homage to a piece of Leo Ornstein 's ? which includes a triple @-@ forte cluster . The most renowned composer to be directly inspired by Cowell 's demonstrations of his tone cluster pieces was Béla Bartók , who requested Cowell 's permission to employ the method . Bartók 's *First Piano Concerto* , *Piano Sonata* , and *Out of Doors* ( all 1926 ) , his first significant works after three years in which he produced little , extensively feature tone clusters .

In the 1930s , Cowell 's student Lou Harrison utilized keyboard clusters in several works such as his *Prelude for Grandpiano* ( 1937 ) . At least as far back as 1942 , John Cage , who also studied under Cowell , began writing piano pieces with cluster chords ; In the *Name of the Holocaust* , from December of that year , includes chromatic , diatonic , and pentatonic clusters . Olivier Messiaen 's *Vingt regards sur l'enfant Jésus* ( 1944 ) , often described as the most important solo piano piece of the first half of the twentieth century , employs clusters throughout . They would feature in numerous subsequent piano works , by a range of composers . Karlheinz Stockhausen 's *Klavierstück X* ( 1961 ) makes bold , rhetorical use of chromatic clusters , scaled in seven degrees of width , from three to thirty @-@ six semitones , as well as ascending and descending cluster arpeggios and cluster glissandi . Written two decades later , his *Klavierstück XIII* employs many of the same techniques , along with clusters that call for the pianist to sit down on the keyboard . George Crumb 's *Apparitions* , *Elegiac Songs* , and *Vocalises for Soprano and Amplified Piano* ( 1979 ) , a setting of verse by Walt Whitman , is filled with clusters , including an enormous one that introduces three of its sections . The piano part of the second movement of Joseph Schwantner 's song cycle *Magabunda* ( 1983 ) has perhaps the single largest chord ever written for an individual instrument : all 88 notes on the keyboard .

While tone clusters are conventionally associated with the piano , and the solo piano repertoire in particular , they have also assumed important roles in compositions for chamber groups and larger ensembles . Robert Reigle identifies Croatian composer Josip Slavenski 's organ @-@ and @-@ violin *Sonata Religiosa* ( 1925 ) , with its sustained chromatic clusters , as " a missing link between Ives and [ György ] Ligeti . " Bartók employs both diatonic and chromatic clusters in his *Fourth String Quartet* ( 1928 ) . The sound mass technique in such works as Ruth Crawford Seeger 's *String Quartet* ( 1931 ) and Iannis Xenakis 's *Metastaseis* ( 1955 ) is an elaboration of the tone cluster . " Unlike most tonal and non @-@ tonal linear dissonances , tone clusters are essentially static . The individual pitches are of secondary importance ; it is the sound mass that is foremost . " In one of the most famous pieces associated with the sound mass aesthetic , containing , " one of the largest clustering of individual pitches that has been written " , Krzysztof Penderecki 's *Threnody to the Victims of Hiroshima* ( 1959 ) , for fifty @-@ two string instruments , the quarter @-@ tone clusters " see [ m ] to have abstracted and intensified the features that define shrieks of terror and keening cries of sorrow . " Clusters appear in two sections of the electronic music of Stockhausen 's *Kontakte* ( 1958 ? 60 ) ? first as " hammering points ... very difficult to synthesize " , according to Robin Maconie , then as glissandi . In 1961 , Ligeti wrote perhaps the largest cluster chord ever ? in

the orchestral *Atmosphères* , every note in the chromatic scale over a range of five octaves is played at once ( quietly ) . Ligeti 's organ works make extensive use of clusters . *Volumina* ( 1961 ? 62 ) , graphically notated , consists of static and mobile cluster masses , and calls on many advanced cluster @-@ playing techniques .

The eighth movement of Messiaen 's oratorio *La Transfiguration de Notre Seigneur Jésus Christ* ( 1965 ? 69 ) features " a shimmering halo of tone @-@ cluster glissandi " in the strings , evoking the " bright cloud " to which the narrative refers ( listen ) . Orchestral clusters are employed throughout Stockhausen 's *Fresco* ( 1969 ) and *Trans* ( 1971 ) . In Morton Feldman 's *Rothko Chapel* ( 1971 ) , " Wordless vocal tone clusters seep out through the skeletal arrangements of viola , celeste , and percussion . " Aldo Clementi 's chamber ensemble piece *Ceremonial* ( 1973 ) evokes both Verdi and Ives , combining the original extended @-@ duration and mass cluster concepts : a weighted wooden board placed on an electric harmonium maintains a tone cluster throughout the work . Judith Bingham 's *Prague* ( 1995 ) gives a brass band the opportunity to create tone clusters . Keyboard clusters are set against orchestral forces in piano concertos such as Einojuhani Rautavaara 's first ( 1969 ) and Esa @-@ Pekka Salonen 's ( 2007 ) , the latter suggestive of Messiaen . The choral compositions of Eric Whitacre often employ clusters .

Three composers who made frequent use of tone clusters for a wide variety of ensembles are Giacinto Scelsi , Alfred Schnittke ? both of whom often worked with them in microtonal contexts ? and Lou Harrison . Scelsi employed them for much of his career , including in his last large @-@ scale work , *Pfhat* ( 1974 ) , which premiered in 1986 . They are found in works of Schnittke 's ranging from the *Quintet for Piano and Strings* ( 1972 ? 76 ) , where " microtonal strings fin [ d ] tone clusters between the cracks of the piano keys , " to the choral *Psalms of Repentance* ( 1988 ) . Harrison 's many pieces featuring clusters include *Pacifika Rondo* ( 1963 ) , *Concerto for Organ with Percussion* ( 1973 ) , *Piano Concerto* ( 1983 ? 85 ) , *Three Songs for male chorus* ( 1985 ) , *Grand Duo* ( 1988 ) , and *Rhymes with Silver* ( 1996 ) .

= = = In jazz = = =

Tone clusters have been employed by jazz artists in a variety of styles , since the very beginning of the form . Around the turn of the twentieth century , Storyville pianist Jelly Roll Morton began performing a ragtime adaptation of a French quadrille , introducing large chromatic tone clusters played by his left forearm . The growling effect led Morton to dub the piece his " *Tiger Rag* " ( listen ) . In 1909 , Scott Joplin 's deliberately experimental " *Wall Street Rag* " included a section prominently featuring notated tone clusters ? apparently the first published work in the history of Western music with a cluster sequence . The fourth of Artie Matthews 's *Pastime Rags* ( 1913 ? 20 ) features dissonant right @-@ hand clusters . Thelonious Monk , in pieces such as " *Introspection* " ( 1946 ) and " *Off Minor* " ( 1947 ) , uses clusters as dramatic figures within the central improvisation and to accent the tension at its conclusion . They are heard on Art Tatum 's " *Mr. Freddy Blues* " ( 1950 ) , undergirding the cross @-@ rhythms . By 1953 , Dave Brubeck was employing piano tone clusters and dissonance in a manner anticipating the style free jazz pioneer Cecil Taylor would soon develop . The approach of hard bop pianist Horace Silver is an even clearer antecedent to Taylor 's use of clusters . During the same era , clusters appear as punctuation marks in the lead lines of Herbie Nichols . In " *The Gig* " ( 1955 ) , described by Francis Davis as Nichols 's masterpiece , " clashing notes and tone clusters depict [ t ] a pickup band at odds with itself about what to play . " Recorded examples of Duke Ellington 's piano cluster work include " *Summertime* " ( 1961 ) and ... *And His Mother Called Him Bill* ( 1967 ) .

In jazz , as in classical music , tone clusters have not been restricted to the keyboard . In the 1930s , the Jimmie Lunceford Orchestra 's " *Stratosphere* " included ensemble clusters among an array of progressive elements . The Stan Kenton Orchestra 's April 1947 recording of " *If I Could Be With You One Hour Tonight* , " arranged by Pete Rugolo , features a dramatic four @-@ note trombone cluster at the end of the second chorus . As described by critic Fred Kaplan , a 1950 performance by the Duke Ellington Orchestra features arrangements with the collective " blowing rich , dark , tone clusters that evoke Ravel . " In the early 1960s , arrangements by Bob Brookmeyer and Gerry

Mulligan for Mulligan 's Concert Jazz Band employed tone clusters in a dense style bringing to mind both Ellington and Ravel . Eric Dolphy 's bass clarinet solos would often feature " microtonal clusters summoned by frantic overblowing . " Critic Robert Palmer called the " tart tone cluster " that " pierces a song 's surfaces and penetrates to its heart " a specialty of guitarist Jim Hall 's .

Clusters are especially prevalent in the realm of free jazz . Cecil Taylor has used them extensively as part of his improvisational method since the mid @-@ 1950s . Like much of his musical vocabulary , his clusters operate " on a continuum somewhere between melody and percussion . " One of Taylor 's primary purposes in adopting clusters was to avoid the dominance of any specific pitch . Leading free jazz composer , bandleader , and pianist Sun Ra often used them to rearrange the musical furniture , as described by scholar John F. Szwed :

When he sensed that [ a ] piece needed an introduction or an ending , a new direction or fresh material , he would call for a space chord , a collectively improvised tone cluster at high volume which " would suggest a new melody , maybe a rhythm . " It was a pianistically conceived device which created another context for the music , a new mood , opening up fresh tonal areas .

As free jazz spread in the 1960s , so did the use of tone clusters . In comparison with what John Litweiler describes as Taylor 's " endless forms and contrasts , " the solos of Muhal Richard Abrams employ tone clusters in a similarly free , but more lyrical , flowing context . Guitarist Sonny Sharrock made them a central part of his improvisations ; in Palmer 's description , he executed " glass @-@ shattering tone clusters that sounded like someone was ripping the pickups out of the guitar without having bothered to unplug it from its overdriven amplifier . " Pianist Marilyn Crispell has been another major free jazz proponent of the tone cluster , frequently in collaboration with Anthony Braxton , who played with Abrams early in his career . Since the 1990s , Matthew Shipp has built on Taylor 's innovations with the form . European free jazz pianists who have contributed to the development of the tone cluster palette include Gunter Hampel and Alexander von Schlippenbach .

Don Pullen , who bridged free and mainstream jazz , " had a technique of rolling his wrists as he improvised ? the outside edges of his hands became scarred from it ? to create moving tone clusters , " writes critic Ben Ratliff . " Building up from arpeggios , he could create eddies of noise on the keyboard ... like concise Cecil Taylor outbursts . " In the description of Joachim Berendt , Pullen " uniquely melodized cluster playing and made it tonal . He phrases impulsively raw clusters with his right hand and yet embeds them in clear , harmonically functional tonal chords simultaneously played with the left hand . " John Medeski employs tone clusters as keyboardist for Medeski , Martin , and Wood , which mixes free jazz elements into its soul jazz / jam band style .

= = = In popular music = = =

Like jazz , rock and roll has made use of tone clusters since its birth , if characteristically in a less deliberate manner ? most famously , Jerry Lee Lewis 's live @-@ performance piano technique of the 1950s , involving fists , feet , and derrière . Since the 1960s , much drone music , which crosses the lines between rock , electronic , and experimental music , has been based on tone clusters . On The Velvet Underground 's " Sister Ray , " recorded in September 1967 , organist John Cale uses tone clusters within the context of a drone ; the song is apparently the closest approximation on record of the band 's early live sound . Around the same time , Doors keyboardist Ray Manzarek began introducing clusters into his solos during live performances of the band 's hit " Light My Fire . "

Kraftwerk 's self @-@ titled 1970 debut album employs organ clusters to add variety to its repeated tape sequences . In 1971 , critic Ed Ward lauded the " tone @-@ cluster vocal harmonies " created by Jefferson Airplane 's three lead singers , Grace Slick , Marty Balin , and Paul Kantner . Tangerine Dream 's 1972 double album Zeit is replete with clusters performed on synthesizer . In later rock practice , the D add9 chord characteristic of jangle pop involves a three @-@ note set separated by major seconds ( D , E , F ? ) , the sort of guitar cluster that may be characterized as a harp effect .

The sound of tone clusters played on the organ became a convention in radio drama for dreams . Clusters are often used in the scoring of horror and science @-@ fiction films . For a 2004 production of the play Tone Clusters by Joyce Carol Oates , composer Jay Clarke ? a member of

the indie rock bands Dolorean and The Standard ? employed clusters to " subtly build the tension " , in contrast to what he perceived in the cluster pieces by Cowell and Ives suggested by Oates : ? Some of it was like music to murder somebody to ; it was like horror @-@ movie music ? .

= = Use in other music = =

In traditional Japanese gagaku , the imperial court music , a tone cluster performed on sh? ( a type of mouth organ ) is generally employed as a harmonic matrix . Yoritsune Matsudaira , active from the late 1920s to the early 2000s , merged gagaku 's harmonies and tonalities with avant @-@ garde Western techniques . Much of his work is built on the sh? 's ten traditional cluster formations . Lou Harrison 's Pacifika Rondo , which mixes Eastern and Western instrumentation and styles , mirrors the gagaku approach ? sustained organ clusters emulate the sound and function of the sh? . Traditional Korean court and aristocratic music employs passages of simultaneous ornamentation on multiple instruments , creating dissonant clusters ; this technique is reflected in the work of twentieth @-@ century Korean German composer Isang Yun .

Several East Asian free reed instruments , including the sh? , were modeled on the sheng , an ancient Chinese folk instrument later incorporated into more formal musical contexts . Wubaduhesheng , one of the traditional chord formations played on the sheng , involves a three @-@ pitch cluster . Malayan folk musicians employ an indigenous mouth organ that , like the sh? and sheng , produces tone clusters . The characteristic musical form played on the bin @-@ baja , a strummed harp of central India 's Pardhan people , has been described as a " rhythmic ostinato on a tone cluster . "

Tone clusters are used in traditional Asante trumpet music : " Intentional dissonance dispels evil spirits , and the greater the clangor , the greater the barrage .

= = = Listening = = =

American Mavericks : Program 1 ? The Meaning of Maverick three works by Cowell on demand , including Concerto for Piano and Orchestra ? its second movement is titled " Tone Cluster , " though all three movements feature them

Art of the States : Henry Cowell six works by the composer , including The Tides of Manaunaun and The Harp of Life , with their chromatic and diatonic clusters , and Exultation , which features pentatonic clusters

Art of the States : John Cage three works by the composer , including In the Name of the Holocaust

John Cage ? In The Name Of The Holocaust video of performance by Margaret Leng Tan  
Ornstein Piano Music Marc @-@ André Hamelin 's performance of Suicide in an Airplane from Leo Ornstein : Piano Music ( Hyperion 67320 )