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Klasik Müzikte Boyutsal Seslendirmeler

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ÖZ

Seste boyutsallık algıda şekillenen bir bileşen, bir oluşumdur. Ses kaynağı nerede olursa olsun, iki kulağın aralarındaki yüz engelli mesafesi ve buna bağlı olarak ortaya çıkan işitmedeki zamansal gecikme algıda boyutsallığı yaratır ve boyutsal algılama, insanda ses kaynağı konumunun tespitini sağlar. Seste boyutsal algılamanın günümüz müzik endüstrisinde bilinen karşılığı genelde teknolojiktir. Kaydedilen müzik mono'dan surround'a kadar çeşitli teknolojik yöntemlerle işlemden geçirilerek tüketiciye sunulur. Ses kayıt tarihinde bu süreç mono ile başlayarak günümüzde atmos'a kadar ulaşmıştır. Oysa doğal bir oluşum olan sesteki boyutsallığın bugün herkes tarafından yukarıdaki terimlerle aranan teknolojik halleri, bundan yüzlerce yıl önce batı müziği bağdarlarının bir kısmı tarafından dinleyiciye zaten sunulmaktaydı. 16. yüzyılda Giovanni Gabrieli'nin koroyu ikiye bölerek "*cori spezzati*" tekniğiyle sunduğu yaratılarında stereo tekniği yatmaktadır. Barok dönemde Vivaldi "*per eco in lontano* (uzaktaki yankı)" adlı Konçertosuyla ilk surround seslendirme örneklerini sunmuştur. Klasik dönemde Haydn ve Mozart, Romantik dönemde Berlioz ve sonraki dönemlerde Ives ve Stockhousen, henüz ortada kayıt kavramı bile yokken dinleyicilere seslendirmede boyutsallığı niteler yaratılar bağdamışlardır. Bu çalışmada, yukarıda sözü edilen bağdarlarla birlikte batı müziği yaratılarında boyutsallığı işleyen diğer bağdar ve yaratıları araştırılmış, elde edilen verilerle imkanlar çerçevesinde bağdarların orijinal partitürleri incelenmiş ve kısaca, müzik teorileri kapsamında boyutsal yaratı olma özelliği taşıyan müzikler analiz edilerek seslendirme örnekleri sunulmuştur. Her ne kadar bu türden yaratılar kendi içlerinde çeşitli nedenlerle açıklanabilir olsalar da yaratıların seslendirimleri incelendiğinde insandaki boyutsal algılama kaygısını ortaya çıkarabilen niteliklerinin de olduğu ortadadır.

Anahtar Kelimeler: Müzik Teknolojisi, Boyutsal Ses, Klasik Müzik, Müzik Performansı

Spatial Sound Performances in Classical Music

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ABSTRACT

Spatial is related to multi-dimensionality in nature. Spatial sound is perceived in three dimensions in relationship with the source location. Thus, spatial sound perception provides the location of sound source. In other words, this capability of localizing sound in space is often referred to as spatial sound. In music technology, spatial sound, which is introduced to the listener through various techniques such as *mono*, *stereo*, *quadro*, *ambio*, *surround* etc., is in the domain of spatial audio studies. Hundreds of years ago, when there was no concept of music technology yet, spatial sound was practiced by a number of classical music composers. Giovanni Gabrieli, in the 16th century, splits the choir in two groups named "*cori spezzati*" similar to the stereo technique. The Baroque period composer Vivaldi's "*per eco in lontano*" can be regarded as the first spatial sound performance with echo technique on a concert hall. In the history of classical music, Classical period composers Haydn and Mozart, Romantic period composers Berlioz and Mahler, and 20th century composers Ives and Stockhausen have composed some pieces which can also be considered as spatial sound performances. In this study, the relationship between classical music composers above and their performances connected with spatial sound will be discussed, examining the original parts of their music and establishing a connection with between their performances and dimensionality. The result of this study points out that some classical music composers can consciously raise awareness in the audience by presenting spatial sounds in their music.

Keywords: Music Technology, Spatial Sound, Classical Music, Music Performances

INTRODUCTION

With the ears positioned on both sides of our head, humans are capable to perceive sound around us. The perceived sound can be processed by our brain to interpret the meaning of the sound (He, 2017, p. 7). According to Rumsey, two ears which are symmetrically positioned with the face barrier are the basis of three-dimensionality in sound, using *direction* and *distance* parameters between sound source and ear (Rumsey, 2001, p. 21). Blauert describes dimensionality in sound with a global function including two variables, *angle* and *distance* (Blauert, 1983, p. 17). These simple relationships allow the vibrations emitted from the source to reach both ears at different times and create a functional dimensionality on perception. This particular situation in the perception creates the spatial sound that emerges from the features of the sound such as direction, distance, angle, frequency, amplitude, timbre, etc.

A large part of the music industry has come to know spatial sound with dimensional terms such as *mono, stereo, ambio, quadro, ambisonic, surround etc*. In the music industry, the *stereo* recording period can be said to have started in the late 1950s, if we briefly mention the previous period as the years with *mono*. The first *stereo* recording offered to the market was released in 1967 by the Beatles with the album named *Sgt. Pepper's Lonely-Hearts Club Band*. The first spatial experiment made after *stereo*, which became a standard for all music recordings after 1970, is *ambiophony*, also known as *Hafler Stereo*. *Ambiophony* refers to the distribution of the right and left sounds positioned as *stereo* to the two rear speakers using certain techniques. In the following years, the developments continued with *quadro* by the doubling of *stereo*. The aim of these experiments, which are used as *quadrophony* in technology, was to capture spatial sound by surrounding the sensor in all four directions. In the mid-1970s, the coding method found by the British scientist Michael Gerzon was adapted to the audio recording industry (Gerzon, 1977). This coding method, reducing the cost of *quadrophony* by half, slowly began to spread all over the world under the name of *ambisonic*. *Ambisonic* is a coding technique added to reduce costs by preserving the digital structure of *ambiophony* and *quadrophony* rather than being a different tool in spatial sound. In 1975, Dolby participated in the quest for spatial sound using the first Dolby Stereo patent in the movie named "*Lisztomania"* which pictures the life of Franz Liszt. With the movie "*A Star is Born*" which was released in 1976, the sector experienced the *surround* technology for the first time, and after the 1990s, it was introduced to the digital environment and reached an audience much faster. With the launch of the DVD in 1996, it immediately became a standard under the name of "5.1" in almost all digital environments. Nowadays, at the point reached today, *Dolby Atmos*, which is relatively new, continues its journey in spatial sound technology. *Atmos*, which added top and bottom planes to right-left based surrounding sounds, is still in the stage of development and introduction to consumers. Today's users are acquainted to those developments mentioned in the short history above. The question to be asked at this point is: Has spatial sound been known and used in classical music before? This study aims to answer this question.…

In classical music, spatial sound was obtained by taking advantage of natural and of course ordinary facilities; moreover, the classical music composers tried to present spatial sound in music to the listener in a variety of ways. However, we cannot say that any classical music composer has talked about spatial sound until now, and has made a verbal or written statement in this matter. In the historical process, only Hector Berlioz, in his explanation of the spatial features in his composing, has indirectly spoken of spatial sound (Bloom, 1998, p. 84). Apart from this, in order to search for spatial sound, it is necessary to examine the few examples of classical music that can be described as spatial sound. In particular, the distinctive sounds are the most important means of detecting spatial sound among others. Apart from this, partitures and notes, interpretation on the sound, notation and musician attitudes, studies and determinations by scientists, and finally, verbal or written statements of composers, if any, can be considered as other clues to show spatial sound in classical music.

It is possible to find some different results of studies about spatial sound in classical music. For example, Fenlon emphasized that the spatial sound would lead to the emergence of spiritual or religious matters in classical music. According to Fenlon, in Pre-17th Century period, some composing was performed to impose the power of church (Fenlon, 1993). While Roginska argue that spatial sound is only a sound effect applied by composers to music actually (Roginska and Geluso, 2017), Richard King refers to it abnormal numerical increase of orchestra instruments in Romantic period (King, 2016). Clozier explains

the situation as a natural consequence of the genre or style of music, staying away from all these results (Clozier and Olsson, 2001).

Although all of the determinations above are accepted, it is emphasized in this study that the available data can be explained with a different result and that classical music composers can consciously raise awareness in the audience by presenting them the spatial sound in their music. First of all, spatial sound in classical music were examined on a periodical basis and compared with today's spatial techniques. The original partitura of the compositions which are thought to have spatial features were examined. Epitomic composition's auditory elements have been analysed and the duration from the first audition to the last have been observed. Related literature has been identified and scanned and the works of researchers in the fields of art and science have been analysed.

PRE-17TH CENTURY PERIOD

Most of the chorale music in Pre-17th Century period (Early and Renaissance period) was patterned around shape of the melody (DK Authors, 2018, p. 20). Church singers (*cappella di cantori*) from central Europe, especially from the north of the Alps, sang for a long time in this way in churches and chapels in Milan, Naples and Ferrara, Italy (Fenlon, 1993, p. 547). At the end of the 15th century, Venice's spiritual power created by commercial wealth and its religious structures led many of the Central European musicians including Ciconia, Dufay, Josquin, and Willaert to move to Venice. By the 16th century, the Basilica di San Marco (BdSM, Patriarchal Cathedral Basilica of Saint Mark) had become the center of chorale music. At the same time, BdSM provided the possibilities for many composers to make effective changes in sound. Giovanni Croce and Adrian Willaert began to perform the melody line by dividing the songs in the choir (*selmi spezzati*). At the end of the 16th century, Andres Gabrieli, Giovanni Gabrieli, and Giovanni Bassano divided not only songs but also the choir into at least two (*cori spezzati*), and held the choir in different places to perform the composing[1] (Bryant, 1981, p. 178).

Particularly the split choir separating the composing of Giovanni Gabrieli from the others can be seen as a natural result due to the architectural structure of BdSM. However, according to Wigfield (2016, p. 76) and Angelini (2014, p. 9), BdSM was a unique tool for the spatial sound that the above-mentioned composers were aware of. In front of the church organ of the BdSM, two symmetrically divided pergolas (*pulpitum novum lectionum and pulpitum magnum cantorum*) together with the organ became the best place in the session of the split choir (*cori spezzati*) (Fenlon, 1993, p. 554). Angelini (2014, p. 9) states that in the split choir method, the composer tries to create a full echo effect by using the acoustic environment for the audience. On the other hand, Angelini's research in the church shows that the symmetrical distance of the two choirs provides the delay time in the sound with a total time of 0.2 seconds (Figure 1). According to Angelini, this situation, the session and sound pattern, which started with the dividing the song for the choir (*selmi spezzati*) with Willaert, and then took shape of the split choir (*cori spezzati*) with Gabrieli, is nothing more than using dimensionality, more sharply called *stereo* as it is known today.

It would not be wrong to assume that BdSM and, of course, Venice, are the beginning of spatial sound performances in classical music. After that, the composers who performed their music with split choir and who is invited from many countries of Europe have transported the spatial sound performances to cities other than Venice. For example, the travelling of Italian composer Alessandro Striggio (1540-1592) to England from Venice in 1567 not only ensured that Europe acquainted with split choir and spatial sound performances, but also paved the way for some composer who created spatial sound performances, imitating their Italian colleagues. Two notable examples of these composers are Thomas Tallis and Orlande De Lassus.

[1] This method also prepared the basis for concerto and symphony that became widespread in the following years.

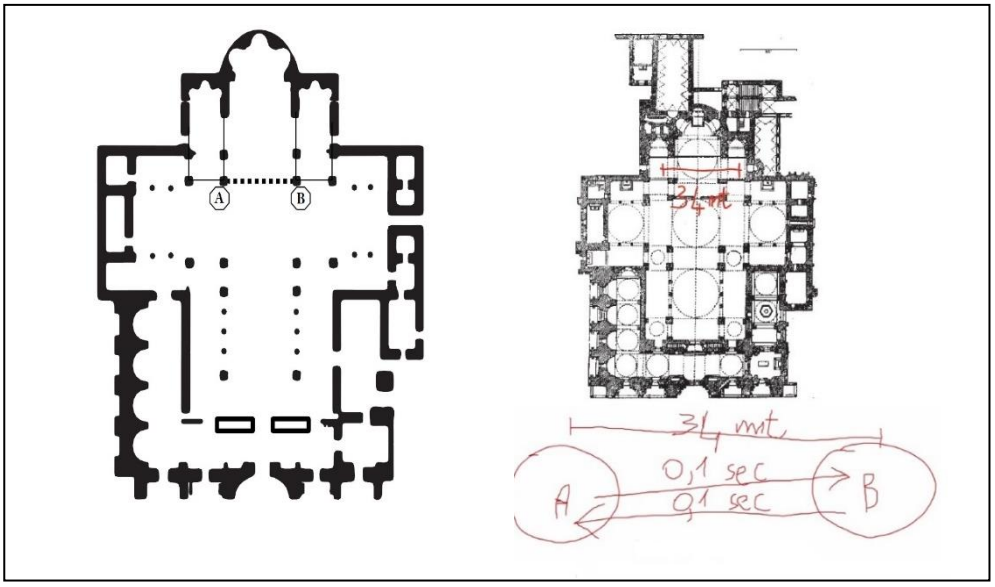

Figure 1: Interior layout of BdSM, Venice (left) A: *Pulpitum novum lectionum (Bigonzo)* B: *Pulpitum magnum cantorum (Pergole)* (Wigfield, 2016, p. 76). Angelini's handwriting (right). The distance between the two choirs with 15 voices, located on Bigonzo and Pergole, is 34mt. and reverberation time is 0.2sn. as measured by Prof. Andrea Angelini (2014, p. 12)

The British composer, Thomas Tallis (1505-1585), performed the first multi choir composing in London Arundel House in 1571 with the motet named "*spem in alium*" consisting of forty voices, which was performed by eight different choirs, each composing of five voices. (Stevens, 1982, p. 172). It was only in 1958 that *spem in alium* was performed close to the original. In this performance, eight choirs form a circle to surround listeners. In other words, the audience is in the middle of a choir that surrounds them. This motet of Tallis is the spatial sound performances recorded with forty channels by Janet Cardiff[2] and performed by forty separate speakers in the form of a circle today (Roginska and Geluso, 2017) [Video 1: Janet Cardiff.avi][**].

Belgian composer Orlande De Lassus (1532-1594), who composed in the later periods of the spatial sound history, incorporated the echo effect, which is more visible in the music of Vivaldi and Mozart. In fact, the first known representative of this effect was Luca Marenzio (1553-1599), who was one of the composers of that period (Apel, 1968, p. 251). Marenzio used the echo effect in some verses of his chorale music named "*O tu che fra le selve*". However, the use of this effect has been associated with Orlando de Lassus, who used it on a composition named "*O la che bon echo*" which is still being performed today. (Begault, 2000). De Lassus was the first composer to use the word "echo" in his music. He achieved this effect by separating some sounds from the others in a single choir, without incorporating split choirs. The choir sang the succeeding repetitions of the words in lower volumes, creating an echo effect as it is known today. In the present performances of this composition, some choirs create this effect by placing a part of the choir in the balcony of the stage or the church [Video 2: Orlando.avi].

BAROQUE PERIOD

Baroque period is known as the period where the choral compositions of the Pre-17th Century period started to become accompanied by instruments or choral pieces are converted into instrumental pieces, preserving their stylistic properties to some degree. It shouldn't be wrong to relate dimensionality to the number choirs in the Pre-17th Century, accordingly to the number of instruments in the Baroque period. Baroque period, which still had no clear definition of the concept of orchestra and lacked the numbers of orchestras required for the dimensionality, has opened the door to orchestral compositions. There are examples of a few spatial performances in the Baroque period, in which spatial sound is

[2] Janet Cardiff, The Forty Part Motet, The Art Gallery of Ontario, April 2013.

[**] All video (.avi) examples can be downloaded from t.ly/2wA7k

embodied in such a way that has never been seen before, from the partituras to the actual performance itself.

If we consider Orazio Benevoli's (1605-1672) split choir performances in Salzburg Cathedral using two organs and two harpsichords as a transition within the choir-instrument relationship (Zvonar 2006), in the Baroque period, the permanent sound examples of dimensional quest are partly found in Heinrich Ignaz Franz von Biber's *Salisburgensis Missa* and precisely in Antonio Vivaldi's *RV 552 A major Violin Concerto*. Biber (1644-1704) knew very well how to use the instrumental possibilities or the architectural structure of Salzburg Cathedral in his composing such as motets, missa, and requiem, he presented his works with split instrument sections as in the split choir method in the previous period. One of the compositions, *Missa Salisburgensis* is considered to be one the best examples of spatial sound performance. In this composition, Biber used two eight-part choirs, consisting of sixteen vocals, which are placed on left and right side of Salzburg Cathedral. This is a different form of spatial sound which can be seen in the previous periods. In *Missa Salisburgensis*, Biber divided the orchestra into two separate groups (two orchestras) to achieve the spatial sound effect. The first group of instruments (first orchestra) consists of six-part strings, two horns, four trombones, two oboes, and four flutes, and the second group of instruments (second orchestra) consists of four trumpets and timpani (Holman, 1994, p. 441).

Antonio Vivaldi (1678 – 1741), one the most important composers of the Baroque period, also used spatial sound. The composition RV 552, A Major Concerto named "*per eco in lontano* (echo from far away)" is the most effective example for spatial sound [Video 3: Vivaldi.avi]. The concerto is composed with three sections (*allegro-larghetto-allegro*) and it was written for three violins, one viola, cello and double bass. Adding three more violins to the existing three violins (main group) in his concerto, he named them as echo of the main group. Generally, echo violins have been placed in balcony of the concert hall since the first performance in Dresden for the Prince of Poland, Friedrich Christian on March 21st, 1740. (Heller, 1997, p. 16). This particular session is the first spatial sound performance by an orchestra, in classical music history. In the present day, the "echo" note can be seen as it's been written down by Vivaldi on his concerto's partitura which have been published as Dresden Concertos in Dresden National Library (SLUB, Die Sächsische Landesbibliothek) (Figure 2).

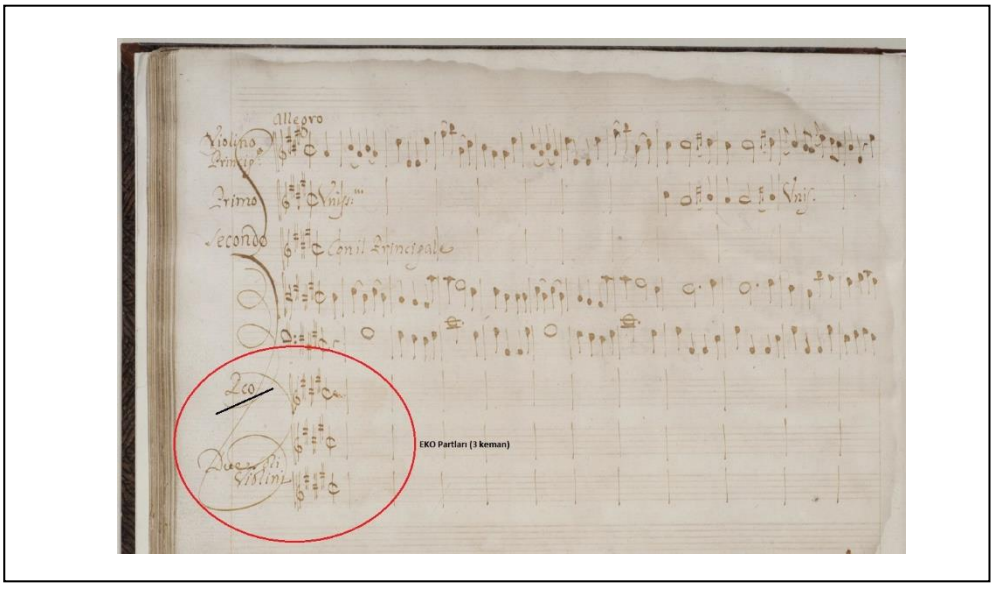

Figure 2: A part of notes of Concerto in A Major, RV 552, Antonio Vivaldi (*per eco in lontano* (echo from far away) (http://www.imspl.org). Vivaldi has written down "echo" notes for three violins which are detached from main group. The echo violins are generally situated in the balcony of the concert hall.

It can be a fact that Vivaldi's use of the echo technique can be considered as a pretty way of using an effect rather than spatial sound. From this perspective, it is possible to say that every unordinary

spatial experiment is actually the use of a sound effect and this applies to all the periods mentioned above. Considering that all music before the Baroque period have been performed for religious rituals, it can be said that all known or unknown phenomena, such as the split choir of Gabrieli and the echo of Vivaldi, are used as effective means of reflecting music on people to enhance the spiritual emotions. But the question to be asked at this point is: Can consider this as spatial sound? Or, if humans had no spatial perception, would these effects be used? To answer these questions, we have to analyse other periods.

CLASSICAL PERIOD

In the Classical period, space (or place) is still important because, as in BdSM (Basilica di San Marco), Salzburg Cathedral allowed composers to embark on a quest with its architectural and acoustic structure. Besides being a very important religious sanctuary. The placement of the five organs in the cathedral which are organized as two on the right, two on the left and one on the back of the altar, makes the cathedral ideal for sound experiments. Furthermore, the cathedral is also known as the place where Mozart was baptized and some of his music was performed.

Although Roginska points out that Wolfgang Amadeus Mozart (1756-1791) wrote the parts of *Don Giovanni* for three separated orchestras -one orchestra in the pit, one onstage, one backstage (Roginska, 2018, p. 46), Mozart's most important composition in terms of spatial sound is K.286 *D Major Nocturne*. The nocturne is an effective example of how Mozart was influenced the spatial sound and place after the Baroque (Erkal ve Yürekli 2007, p. 48). The nocturne which is considered to have been composed in early 1777 is for four orchestras, each consisting of two violins and two horns, as in no other example (exactly two horns, two violins, one viola, and one cello) (Huscher, 2000). The first orchestra plays on the stage, while the others play at distances far from each other and the stage (stage, balcony, backstage, pit, etc.) (Figure 3) [Video 4: Mozart.avi].

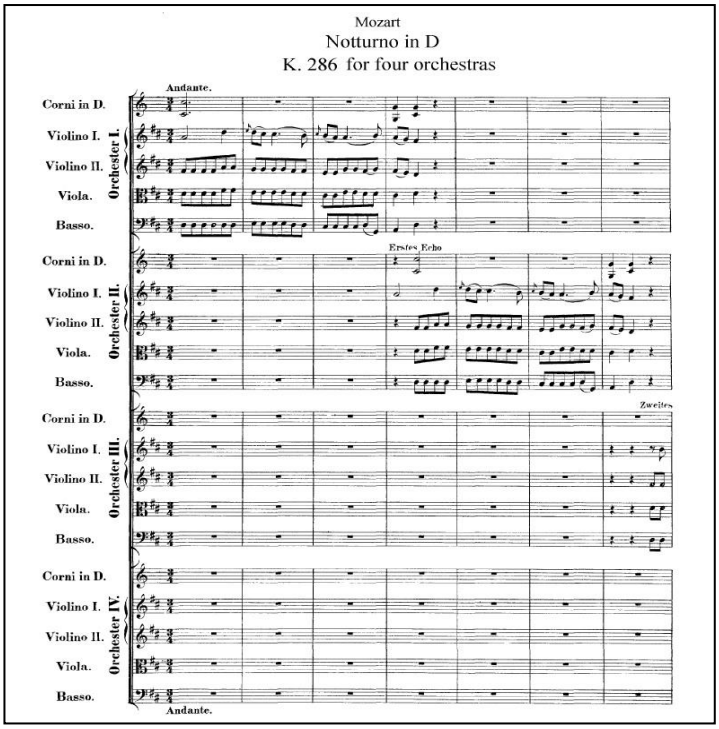

Figure 3: The first page of Notturno in D major, K.286, Mozart. Separate staffs for orchestras 1-2-3-4 and the "echo" notes. (http://imslp.org/).

Joseph Haydn's (1732-1809) divertimento in E flat major for two orchestras, with each orchestra having two violins and one cello, is one of the most popular examples of spatial sound. Haydn divides the partitura into two parts as "*first room (erstes zimmer)*" and "*second room (zweites zimmer)*". Since two orchestras play the same musical lines at different times, the second orchestra feels like the echo of the first orchestra. This is a specific feature that is not being the other performances. The first

orchestra plays the notes of the last measure; second orchestra repeats these notes instead of repeating all the last measure. This way of performance creates the perfect echo effect. Hob I: 38-Symphony No. 38 in C Major, composed by Haydn, also uses the echo effect to bring out spatial sound. Haydn makes the audience perceive spatial sound very clearly by placing one of the two violins out of the stage in his symphony. Both Mozart and Haydn explain this situation in a very precise and clear way: Echo (*das echo, erstes echo, zwites echo* etc.) (Figure 4).

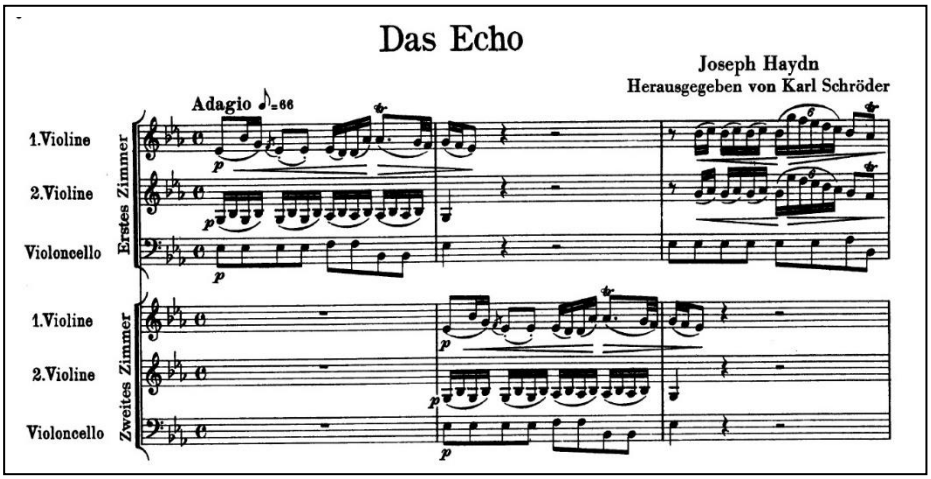

Figure 4: Starting page of Divertimento in E-flat major, Hob.II: 39 (das echo), Joseph Haydn. Attention to the numbers of room (*zimmer*) for both orchestras with 2 violins and 1 cello (http://imslp.org/)

As mentioned earlier, we have seen that the echo effect is frequently used in choral and instrumental music by many composers such as Sweelink, Tunder, Reinken, Buxtehude, Nivers, Gigault (Apel, 1968, p. 251). Vivaldi is the representative of the effect in the Baroque. The use of echo has reached its peak with Mozart and Haydn in Classical period. In Romantic period, Mahler with his 2. Symphony, and Verdi with his Requem, and Berlioz became significant representatives of the use of the echo effect.

ROMANTIC PERIOD

In the Romantic period, we can see that spatial sound is used more effectively compared to the previous periods. The use of orchestra as a tool for achieving spatial sound in the previous periods left its place to techniques and sounds which are consciously applied giving rise to a special compositional style called "symphonic poetry". On the other hand, the possibilities made available by the space continued to have a strong effect in this period. For example, Berlioz, who composed the most effective spatial sound performances of the Romantic period, emphasizes the importance of the place in the Romantic period in dimensionality as follows: "*Many people do not really think that the places where music is made can be a musical instrument and that these places can act as a musician vibrating the bow or string of a violin, viola, cello, contrabass, harp, and piano*" (Bloom, 1998, p. 84).

Symphonic poetry takes its origins from "programmed music" which dates back to Vivaldi's *Four Seasons*, in which a visual design is presented with auditory elements. For example, in Richard Strauss's op.35 symphonic poem, the story of Don Quixote is narrated, while in Berlioz's Fantastic Symphony there is a love story. In a pattern where the melody line and accompaniments change momentarily, the transitions of instruments are sharpened, and nuances suddenly decrease and increase, the spatial sound makes music thus the spatial sound elements make the music more realistic for visual imagination.

Hector Berlioz (1803-1869), with his po.5 *Requiem* (*The Grande Messe des Most*), is one of the most effective composers of spatial sound performance in the Romantic period. In Berlioz's Requiem the symphonic poetry style becomes prominent and the duration of the performance is increased. There are 38 brass instruments amongst 220 total number of instruments and 200 voices. These are placed in five separate points of the concert hall. The placement of orchestra without brass is in the middle of the stage and the copper brass instruments in the hall is as follows: Two groups on the left and right of the stage; two groups on the left and right between the audience on the balcony. So briefly, according

to today's surround speaker layout: Left, right, center, rear left and rear right… [Video 5: Berlioz.avi]. Besides being just a set of sound sources in a place, this setup creates a single three-dimensional immersive environment whose spatial characteristics could be controlled to some extent through careful orchestration and ensemble placement (Roginska and Geluso, 2017, p. 47).

20TH CENTURY AND LATER PERIOD

Since 20th Century and Later period (Modern and Contemporary period), the lay-out, which was first shaped by the number of choirs and then by the number of instruments and orchestras, evolved into a strong direction in which much more experimental allowing freedom of design, like in all arts after the Romantic period. In 20th Century and Later period, music has been more numerical and rebellious than ever before. It is numerical because, from the twelve-tone serialism of Schönberg to Schenkerian analysis, music production has never been based on such theoretical data (Cook, 2007, p. 27). It is rebellious because many of the most 20th Century and Later period composers reject the past products of classical music once and for all and seek innovation. Due to this particular situation, the concept of spatial sound started to manifest itself in music than ever before, and in the following periods, it emerged as a new field of research and a new technology.

Due to the above-mentioned features of recent period, a lot of composers such as Schoenberg, Adorno, Ligeti, Kagel, Rochberg, McDermott, Boulez etc. have used the spatial sound in their music. However, in this period, there are some composers who transform the spatial sound into a technique and they have become much more popular in terms of spatial sound techniques. For example, American composer Charles Ives (1908-1954) in "*The Unanswered Question* (UQ)" has produced one of a unique performance and technique related with spatial sound [Video 6: Ives.avi]. The UQ was recomposed by Ives who extended the orchestra in 1930s and it ended with its the first performance in 1946. The obvious spatial sound effect among instruments are the flute's Answers to the trumpet's Question that repeats the same short motive again and again (McDonald, 2004, p. 271). Ives was influenced in this by his father George Ives, a Civil War bandmaster and music teacher, whose own experiments with spatial music included directing two marching bands to move through the town square from different directions (Zvonar, 2006, p. 2). The UQ has affected many composers of recent period, especially Henry Brant. Brant (1913-2008) was strongly influenced by Ives's use of space, particularly in The UQ. Whereas the previous examples have largely been major composers for whom space was a minor effect, Brant is in many ways the opposite while not a dominant figure in 20th Century and Later period, Brant's body of work embraced and explored spatial sound more than any acoustic composer before him (Roginska and Geluso, 2017, p. 48) [Video 7: Brant.avi]. Ives who is in contact with the following generations, in fact, represents the transition from Romantic to 20th century and later period using the UQ: Neither a poetic narrative that moves around a linear melody of the Romantic period, nor a dense theme built on the independent theoretical framework of the recent period. Therefore, the UQ is much more metamorphic than the examples of spatial sound performances that come after it.

After Ives, German composer and director Stockhausen (1928-2007), one of the most influential composers, can be cited as an example for spatial sound performances in the recent period. In the "licht" opera, in which the composer depicts every day of the week, references to temporal loops take an important place. During these references, he used dense object sounds with music and tried to spread them all over the space of sound as much as possible. In the composition depicting Thursday, he arranged the performance of a trumpet in a giant mechanical cylinder that rotated on the stage. Another example is his composition named "*group orchestra*", a piece in which he placed three orchestras, led by three directors, one to the right, one to the left and one in the front (center) of the stage. He presented an entire example of dimensionality, with other emphasized sounds instantaneously joining the orchestra. However, there is no other composition than Stockhausen's "spiral" which reaches the peaks of spatial sound in recent period. In the composition which was composed in 1968, a short-wave radio is heard in the leading role, which was performed in Connecticut, USA. A musician (e.g. oboe artist Hans Holliger) accompanies the sounds randomly emitted from the radio bands with his instruments and voice. The musician or the person in charge of the sound system uses the radio. In the performance of this very special music in 1970 Osaka Expo,

Stockhausen used the radio and sound system himself. Moreover, the sound space in the fair was designed entirely for this specific composition. The space is a huge global structure. The speakers placed on the ceilings of the space surround the listeners, providing the dimensionality to the performance. In addition to all of these, Stockhausen's experimental approach in his composition "Sirius", where the sounds of trumpet, saxophone and vocals are heard with the "flanger" effect of the speakers surrounding the stage, and many more experimental works makes Stockhausen one of the leading composers of the 20th Century and Later period in spatial sound (Erkal ve Yürekli, 2007, p. 48).

Examples such as Edgard Varese and Iannis Xenakis can be seen among the 20th Century and Later period composers that made a dimensional performance by constructing a special space for sounds as in Stockhausen. Iannis Xenakis (1922-2001) performed his music named "*Concret PH*" in a space constructed by Philips company at 1958 Brussels World's Fair, while in the same building French Edgard Varese (1883-1965) performed his composing named the "electronic poem (*poeme electyronique*)," which contains spatial sound supported by visual elements. This special space, surrounded by approximately 450 speakers and supported by groups of projectors, is one of the best examples of the space-sound relationship that has emerged in the 20th Century and Later period spatial sound in both composers.

The most important change observed in dimensionality that are heard in the compositions of the recent period, is the use of specialized sound systems created by composers, thanks to the technological contributions from music technology. During the performances the composer uses and/or directs many devices, such as microphones, mixing consoles, signal processors and the loudspeakers, which are fully compatible with each other. Besides performing all these tasks, there is one composer who also performs his music with spatial sound, designing and changing the layouts of the speakers. That composer is the French composer Christian Clozier (1945-…), known by his own spatial sound system named "*gmebaphone*[3]".

Gmebaphone is a system with a mixing console, speakers, amplifiers and a large number of sound processors. It is generally designed for indoor performances. The composer calls this system an instrument (Clozier and Olsson, 2001) [Video 8: Cloizer.avi]. Although the instrument is constructed with a large number of hardware parts, the performance is based on speakers. Numerous speakers connected to the system are placed between the stage and the audience so that dimensionality is presented to the audience as well as many components from the pattern to resonance.

CONCLUSION

In the history of classical music, a variety of claims have been put forward to discuss compositions with different orchestral sections and unusual sounds. In relationship with the period of the compositions, all of these claims are based on acceptable reasons: To demonstrate the spiritual power of the church (Fenlon, 1993). To search for sound effect as a different instrument (Roginska & Geluso 2017). An attempt to find a place for the musician on stage because of abnormal numerical increases (King 2016) or a natural result of the music, genre, and style of the period (Clozier and Olsson, 2001). Angelini associates these different compositions directly with spatial sounds, which initially started as a split song (*selmi spezzati*) with Willaert, and then took shape as a split choir (*cori spezzati*) with Gabrieli. These are the first reflections of spatial sound in classical music (Angelini, 2014, p. 9).

The data obtained in this study shows that Angelini's view of the spatial sound or the concept of dimensionality can be accepted as a concept or formation which can be explained by specific sound examples in classical music, and that it is consciously being conveyed to the audience by the composer. Spatial sound in classical music, which started with the division of choir in the historical process, highlighting the echo effect in the sound with various techniques, continued with the division of instrument and orchestra numbers and turned into a sound-effect use by incorporating space in 20th

[3] The "gmebaphone", developed by "Groupe de Musique Expérimentale in Bourges" in France and formed by the combination of the initials of the band, is also known as a "speaker orchestra" due to a large number of speakers, which have been generally placed on the stage globally and managed by a central sound system since 1973.

century, corresponds to today's surround concept substantially. We have seen in Hector Berlioz's Requiem that the placement of the copper brass instruments in the hall was arranged in accordance to today's surround speaker layout: Left, right, center, rear left and rear right…

In Classical period, spatial sound performances are presented to the audience by various techniques: To place the instruments or chorus at various points within the place by dividing their numbers, performing music with temporally delayed sounds, performances from outside of the stage by musicians who are invisible to the audience or composing with the latest technological facilities etc. Although such performances are connected to each period in classical music, the number of composers is quite limited. Gabrieli, Bassano, Vivaldi, Bieber, Mozart, Haydn, Berlioz, Mahler, Stockhausen, Ives are the most prominent composers who use spatial sound in their music.

When we look at the partituras of these composers, we can say that this "sound" is intended for the spatial perception of the human ear. Moreover, almost no composer directly said that "my music bears a spatial feature" except for Berlioz, who stated it indirectly. To give a reason, it would not be wrong to say that the concept of "spatial sound" was not defined and didn't carry the same meaning as it does today. This, however, does not indicate that any of the above-mentioned composers, who marked their own periods with their effective composing, produced spatial sound unconsciously or coincidentally, or that they produced such composing to appear to be different. On the contrary, it can be argued with the results obtained in this study that these composers were fully aware of the spatial perceptions of human beings although with fewer details, and in order to make this perception felt by the audience, they intentionally and voluntarily produced some different music in their repertoires with the sessions and sounds.

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