Shaping music visually

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Uses of 'shape' by musicians

'Shape' and 'shaping' are notions very often used by musicians to talk or think about musical performances. Over 90% of a large sample of musicians reported they would think about shape when thinking about how to perform music (Prior, 2011). When investigating what exactly it is musicians mean by shape it was revealed that connotations varied broadly among performers, yet each individual had a very clear idea of their personal use of shape. According to Prior's online survey (2011) 'shape' encompasses a variety of concepts that are either already given (such as the musical structure of a piece, i.e. the score) or that are added by a performer. The majority of musicians' associations are located within the latter category, and examples include the expressive parameters (dynamics, articulation) of a single note or a phrase, the accompanying body movements to produce musical sound but also the shape of a whole concert programme, for instance. Remarkably, the fact that individual connotations diverge tremendously does not seem to hinder communication between performers or between music teacher and student. It seems as though the notion of musical shape needs no further explication to allow for musical ideas to be exchanged. And not only performers make use of the notion of shape: listeners, critics, musicologists, and other music scholars alike have been found to communicate seemingly smoothly when talking about the shape of music.
It should come as a surprise then that given its obvious ubiquity research on musical shape has only very recently attracted the attention it deserves.[1]
My own research is concerned with visualization of sound and music, which was identified as primary association of shape by a small minority of musicians only. However, I want to argue here that although musicians may not consciously make this connection when they are being asked, it does exist latently in everything they describe.

How visual aspects are always part of musical shapes (4 examples)

The tendency to describe music in visual terms or to think of music as something visual may at first seem odd, but I would like to give four short examples in order to illustrate that music is in many ways visual too.
First, there is the musical score which is a visual representation of the notes to be played and the starting point for any performance of Western classical music. The way in which the notes are arranged on a page are deeply ingrained in musicians' minds and it seems reasonable that musicians map pitch, for instance, onto a vertical space (Walker, 1987a) due to their enormous exposure with sheet music. In this sense, music is visual because of performers' engagement with musical scores.

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[1] Established in 2009, 'Shaping music in performance' is a research project based at King's College London and part of the AHRC Research Centre for Musical Performance as Creative Practice (http://www.cmpcp.ac.uk/smip.html) aiming at approaching musical shape from a variety of perspectives.

Secondly, during the preparation of a piece for a performance musicians discuss among one another or with their teacher (or if they are on their own they might recall talking to other people about) the way the notes should be played, i.e. the dynamics, articulation, phrasing, expressiveness etc. This is frequently accompanied by some sort of body movement, be it a hand or arm gesture to depict the shape of a phrase, the facial expression to indicate the gloomy character of a chord, or the use of the whole body to demonstrate that the music's nature is a dance, for instance.[2] In other words, visual cues provided by body movements are at the same time facilitators of musical communication as well as essential components where our language reaches its limits. In this sense, music is visual because of the way performers communicate interpretative aspects of a piece of music.

Thirdly, some musicians report experiencing visual imagery in response to, and when practising music (Persson, 2001; Prior, 2011). For instance, they may experience visualizations ranging from concrete entities (landscapes, ships, people) to abstract lines, shapes and colours[3]. One may even have more complex experiences, thereby crossing the boundaries to other senses, such as feelings of going up and down, forwards and backwards, inside and outside, or increasing and decreasing (Eitan & Granot, 2006). It is highly likely that perceiving music entails combinations of sensory co-activations of all kinds that are further dependent on cultural, contextual, situational and personal factors. Interestingly, these kinds of musical shapes work the other way around: whereas for the first two examples sound was triggered by visual stimulation, the third example shows how musical shapes are elicited by auditory stimulation. In this sense, music is visual because it conjures up internal images. Notably, the first two instances described above are focused on the performer, whereas the third may be applied likewise to the listener. In fact, the listener plays a very important role here since all performances are directed towards a virtual or real audience.

Fourthly, a further development can be seen where classical musicians work together with visual artists in order to transform the experience of the performance for the listener.[4] Moreover, in contemporary art music, especially electro-acoustic music, it is not at all a rare phenomenon to have some kind of visual accompaniment (e.g., videos, dance). In this sense, music is visual because of the explicit use of visuals during music performances.

Shape, visualizations, and their independence from language

It is important to point out that shape as visualization of music is a phenomenon independent of language. While 'shape', the Spanish equivalent 'forma', or the German

[2] There are plenty of masterclasses available on youtube.com, for example S. Isserlis' Rachmaninov masterclass at http://www.youtube.com/watch?v=OJ0t-vNlL6A. Another very worthwhile example is the documentary 'Set the Piano Stool on Fire', showing Alfred Brendel working with his student Kit Armstrong.

[3] This sort of mapping can be traced back as far as to Aristotle: "[…] and, accordingly, we may regard all these colours as analogous to concords, and suppose that those involving numerical ratios, like the concords in music, may be those generally regarded as most agreeable; as, for example, purple, crimson, and some few such colours, their fewness being due to the same causes which render the concords few." From Monteith (1912, p. 88) amended in line with the critical edition *The complete works of Aristotle: the revised Oxford translation* (Barnes, 1984).

[4] A noteworthy recent example is the collaboration between classical pianist Leif Ove Andsnes and visual artist Robin Rhode (http://www.picturesreframed.com/).

translations 'Form' and 'Gestalt' may all have slightly different lexical definitions and etymological origins, the underlying psychological *concept* with regards to music and visualizations seems to be the same (Prior, 2010). That is not to say that musicians' *use* of shape has always been the same. In fact, we do not know when and where the first musicians began to think and talk about the word, let alone the concept of, 'shape' in reference to musical performances, though it was used as a synonym for musical form in 1876 (Stainer & Barrett, 1876), and to mean musical expression in 1913 (Matthay, 1913). We also do not know whether they were using other words beforehand to refer to the same concept. Metaphors as well as semantics of words change over time, and so do the groups of people who apply them (Knowles, 2010). On the other hand, taken out of the musical context, shape lends itself splendidly to associate something visual or visualisable[5], and it appears reasonable for musicians to use such a word, thereby facilitating communication by stimulating another modality.

Where visualizations of music appear in the literature

Returning to the assertion that visualizations are always latently present when musicians refer to shape and shaping, the above mentioned examples should have made clear that music can readily be related to a number of visual phenomena, and the list of examples provided is surely not exhaustive but may well be extended to other areas. Thus when investigating music and shape, it seems almost obvious to ask: How do musicians and listeners represent sound visually? Examining the relevant literature, it is revealed that the study of music as visual phenomenon has many facets and appears, directly or indirectly, in various (sub-) disciplines of developmental psychology, psychophysics, neuroscience, and music psychology. More specifically, it encompasses research topics such as the development of musical understanding in children (Bamberger, 1995; Barrett, 2005; Hair, 1993, 1997, 2000), graphic representations of music (Elkoshi, 2002; Gromko, 1995; Tan & Kelly, 2004), cross-modal mappings of basic sound characteristics (Sadek, 1987; Walker, 1978, 1985, 1987a, 1987b; Welch, 1991), synaesthesia (Goller, Otten, & Ward, 2009; Ward, Huckstep, & Tsakanikos, 2006; Ward, Moore, Thompson-Lake, Salih, & Beck, 2008), and visual aspects of musical performance (Dahl & Friberg, 2007; J. W. Davidson, 1993; Griffiths, 2010; Killian, 2001; Vines, Krumhansl, Wanderley, & Levitin, 2006) to name but a few.

How musicians visualise sound

As implied above, investigating visualizations of auditory stimuli, that is, how people represent sound and music visually, promises to be a fruitful endeavor and is tightly linked to the question of how musicians use the notion of shape. When considering the matter of 'shaping music in performance' the objectives seem to be clear: it addresses the process of how musicians shape the sound in a musical performance. However, having discussed briefly the relation between musical performances and visualizations, it is not at all far-fetched to think of shaping music in terms of a 'visualization performance'. If visualizations are both triggered by and give rise to musical experiences, any performer of music should have an earnest interest in finding out how their audiences approach music visually (as well as emotionally, culturally, intellectually, etc.). But in order to understand the communication process fully, it is important to explore the ways in which musicians themselves perceive sound and music visually. To my best knowledge, only three studies

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[5] A glance into the Oxford English Dictionary reveals that 'shape' is defined as "external form or contour" (shape, n.1.)(shape, n.1.).

have tackled this question, each of which focused on different aspects of music: whole compositions, basic sound properties, and rhythm.

Tan & Kelly (2004) asked musically trained and untrained listeners to "make any marks" in response to short musical compositions, and their results revealed that the group of musically trained participants chose abstract ways to represent the music, while the untrained group preferred pictorial representations. Moreover, musically trained participants focused on intra-musical properties (melodic line, key changes, instruments) as opposed to extra-musical properties (emotions, images, stories), which were favored by the group of musically untrained participants.

Using a forced choice paradigm to identify participants' visual metaphors (horizontal space, vertical space, pattern, and size) for basic characteristics of sound (frequency, waveform, amplitude, and duration), Walker (1987a) found that musical training had the greatest impact on the consistency of participants' matchings. Other factors such as age, cultural, and environmental background influenced the consistency to a lesser degree. The finding that frequency is associated with the vertical space, waveform with the pattern, amplitude with the size, and duration with the horizontal space should be considered with caution though, as participants were "forced" to choose from a range of graphic representations, and results were analysed in terms of right and wrong answers.

To complete the set of studies which asked musicians or musically trained adults to represent sound and music visually, a study run by Smith and colleagues (Smith, 1989; 1994) will briefly be mentioned here, as it dealt with the representation of rhythm.[6] Presenting a group of children and adults with rhythmic sequences, they examined their representations and reproductions in drawing, clapping, and join-in clapping tasks. A sub-group of musically trained adult participants showed more metric representations compared to musically untrained adults who used figural representations.[7] The same musically trained participants also performed more accurately in the other rhythm tasks, which was interpreted as an effect of musical training by the authors.

How listeners of all levels visualise sound

Broadening our focus to adult listeners with varying or no musical background, there are a few studies which have looked at visualizations of music.[8]

Hooper and Powell (1970) wanted to find out whether drawings produced in response to music differed according to the type of music, the listening engagement, and the setting. Their results revealed that participants' drawings were more elaborated for 'absolute music' (compared to 'program music'), when participants actively engaged in the listening process (e.g. by accompanying the music rhythmically), and the music was presented in a live setting (compared to a recording).

Gromko (1995) compared visual and verbal representations by adults with no musical background. The musical excerpts were taken from several 18th- and 19th-century pieces, and the drawings and verbal descriptions were coded after the experiment to fit one of three categories: the first included extra-musical ideas, the second encompassed

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[6] Since the study of rhythmic sequences as an isolated phenomenon is beyond the scope of this paper, the interested reader is referred to J. Bamberger's work on children's understanding of rhythm (Bamberger, 1982, 1995).

[7] These distinctions were first identified by Bamberger (1982). 'Figural' refers to a type of representation focusing on the surrounding rhythmical events while 'metric' representations focus on the underlying beat of a rhythmic sequence.

[8] For the sake of this paper, only studies that applied active visual response paradigms will be discussed here.

enactive representations of the music's action, and the third category referred to intra-musical properties. It was found that fewer than 50% depicted musical elements such as the melodic line, rhythm or texture and this percentage was even lower for the verbal descriptions. Those participants who did represent musical characteristics chose predominantly the rhythm, and only 5% of the total sample went beyond that to depict other musical elements.

These findings are in concordance with Davidson et al. (1988) who discovered that visual representations produced by musically untrained adults resemble those of untrained seven-year-olds. In their study, they asked both musically trained and untrained adults and children to generate notations of two popular songs ('Happy Birthday' and 'Row, Row, Row Your Boat') with the intention of examining differences between the perceptual knowledge of familiar songs (that we all have) and the notational knowledge (that is acquired through musical training). Their findings that untrained participants produced even richer graphical representations were discussed with regard to implications for music education.

Similarly, Dunn's (1997) focus was on creative listening in the broader context of music education when he asked a group of students to make visual representations of a waltz, to inspect their drawings afterwards and to describe them verbally. Applying a qualitative analysis, his results revealed that, some basic commonalities notwithstanding, most of the drawings and verbal descriptions appeared to be unique. Also, participants without musical training paid more attention to global aspects of the music.

The value of visualizations of music and future directions

Taken together, it should have become obvious that music is certainly something that is "co-created by the listener" (Dunn, 1997, p. 54), and that visualizations of it have great potential to "provide an overt response to shed light on covert aspects of music cognition" (Tan & Kelly, 2004, p. 193). Both expert and novice listeners' drawings reveal a lot about what musical properties are most salient to them, and the strategies used to depict sound visually give a valuable insight into musical thinking. Future studies should address the question of how musicians represent very basic characteristics of music (e.g., pitch, loudness) in a free drawing paradigm, as no such study has been conducted yet. Furthermore, technological and methodological progress can be used to obtain exact digitalised measurements of drawings, thereby allowing for new exciting investigations into the *process* of shaping music visually by studying participants' real-time representations of music as they draw along with the sound. In doing so, information becomes available not only about the final product of the visualization, but also about the process of how musicians and non-musicians arrive there, which opens up further analyses into other areas of music research such as the role of motor movements. Evidently, the study of musicians' use of shape entails a variety of approaches, and the investigation of visualizations of music by both musically trained and untrained participants appears to be a highly pertinent endeavour.

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