UNDERSTANDING ANIMATED NOTATION

Christian M. Fischer
Estonian Academy of Music and Theater
mail@c-m-fischer.de

ABSTRACT

Alternative notation approaches become more and more popular. Animated notation is one of them. It is popular mainly because it seems easy to apply. On the other hand, practice shows that classically trained musicians, composers and musicologists tend to reject or misunderstand this kind of music notation. Furthermore some musical performances based on animated notation should face the question whether a regular notation would not have been more efficient. As a researcher, performer and composer working with animated notation, I experienced that there is still a lack of knowledge and some misconceptions when it comes to animated notation, its advantages and its disadvantages and foremost its practical application. A brief look into the development of animated notation, actual fields of application, an attempt of a typology, an examination of the visual communication process and a closer look at two different animated score examples will shed a little light into the darkness and support utilizing this tool in contemporary music practice.

INTRODUCTION

After a peak in the musical avant-garde of the 1950s and 1960s, approaches of alternative music notation face a renaissance recently. Although there was some interest before, especially from visual artists, Theresa Sauer's book *Notations 21* from 2009 as a direct successor of John Cage's *Notations* from 1969 seems to have been somehow the starting signal. Of course the same problems regarding alternative notation arise now as they did in the mid of the twentieth century. Questions regarding the applicability, the accurateness and whether it is music notation at all, came up. In the recent years various papers and professional literature appeared. The December 2014 issue of *Organised Sound*, this very conference and of course contemporary music practice reveals a still growing interest in the field. New technologies continuously find their way into music performance and music notation and all its manifestations like gesture notation, screen scores, various forms of extended notation or live generated scores. One kind of notation that is used more frequently in the recent years, but at the same time remains a kind of mystery is animated notation. Animated notation serves in this text as an umbrella term for various approaches, where abstract graphics (avoiding images, symbols or pictograms with an inherent meaning) are put into motion for music notational purposes and manifest as fixed media. Hence, any kind of interaction or live generated and live manipulated scores are excluded. In practice animated scores are often shown simultaneously to performers and audience. As a score, it communicates the music and supports the understanding of the structure of the piece. However, to show it to the audience is neither obligatory nor important for the understanding of animated scores in general. The most common form of music notation in the Western world is regular staff notation. In this paper staff notation serves as a kind of reference, to support the understanding of animated notation.

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A BRIEF LOOK INTO HISTORY

As many of our contemporary music practices, animated notation is rooted in ideas and works of the musical avant-garde between 1950 and 1970 [5]. In that time many famous composers were exploring alternative music notation. Publications of that time reveal that those approaches were quite diverse. John Cage in the USA and Erhard Karkoschka in Europe published widely recognized books in the late 1960s that collected various works of that time [3, 9]. In these compilations one can find for instance notations that were merely musical scores. Musical graphics, a term coined later by Roman Haubenstock-Ramati [5], were considered to work rather as a trigger for improvisation than to be a proper musical score. Earle Browns' piece *December 1952* [8] is the first musical graphic, although it appears in some writings mistakenly as a graphic notation. Composers like John Cage, Morton Feldman, Mauricio Kagel, Karlheinz Stockhausen or Roman Haubenstock-Ramati [18, 19], to name but a few, were mainly driven by the limitations of

staff notation to communicate their musical ideas [9]. Some composers even experimented with video scores [5]. The diversity of appearances and the desire to overcome restrictions is common for avant-garde graphic notation and animated notation today.

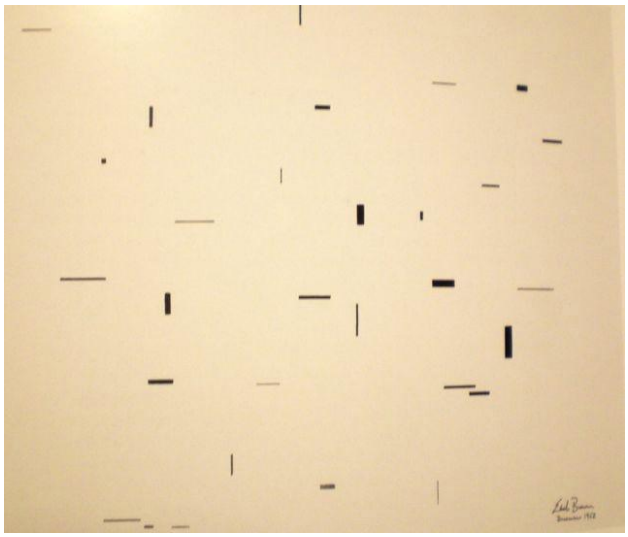

Figure 1. Musical Graphic, *December 1952* by Earle Brown [21].

From the 1970s onwards, composers seem to lose interest in the graphic notation. According to Julia H. Schröder visual artists developed ideas further as "their interest in the individual handwriting manifesting itself in musical graphics is greater than that of composers, who were concerned with the establishment of a new, normative graphic canon" [5]. Schröders analysis reveals two important distinctions regarding graphic and animated notation. First, avant-garde composers wanted to develop a generally applicable kind of graphic notation, implying a certain framework and rules to be able to work with it like with staff notation. As this did not work out, they lost interest. Second, avant-garde composers' self-conception and position within music history regarding the development of a new notation was entirely different from the situation of animated notation today. In *"Darmstädter Beiträge zur neuen Musik – Notation"* [19] composers like Brown, Kagel and Haubenstock Ramati wrote about their practices using graphic notation. For them it was clear and self-evident that the composition of new music required a new music notation. Furthermore this new notation could only come to life by somehow overcoming regular staff notation [19]. Today, animated notation can be considered a tool. It extends possibilities of notating contemporary music without neglecting other techniques or abandoning staff notation. Thereby animated notation or people using it respectively, are not aiming to establish a rigid framework and generally applicable rules.

Since the 1970s very different connections of sound or music and visuals came to life. Visual music, VJing and especially music video shaped our everyday culture like film, art, advertisements and of course music itself [10]. Technological progress, manifesting for instance in ubiquitous computer power, had a major impact on music production, performance and consumption [4]. Regular staff notation on the other side underwent only minor changes in the last 50 years, while its core system, meaning how music is principally notated, remained the same. Surely influences of the developments of the avant-garde can be traced in today's notation practice. Very often staff notation is extended by individual signs and symbols to indicate sounds or techniques that are otherwise not communicable. In 2013 Christian Dimpker published his book *Extended Notation* that develops a consistent notation system for extended instrumental playing techniques and electro acoustic music, based on the common practice [6]. Generally staff notation remains surely satisfyingly expressive. However, compared to the influence of the computer on music itself, music notation (apart from notation software like *Sibelius* or *Finale*) seems to be almost unaltered by technological progress. Only in the recent years, with concepts of interdisciplinarity, inter-media and hybrid arts, a growing interest in alternative notation utilizing computational power can be found. Practice shows there are multiple areas of application that feature new ways of music making and composition. Animated notation is just one amongst many. Yet, the utilization of screens and animation techniques for notational purposes is in its early stages. Even a commonly used term for this kind of notations can hardly be found. Australian composer and researcher Lindsey Vickery generally calls them screen scores [20] while Severin Behnen talks in his PhD thesis about motion graphic scores with its subdivisions animated, interactive and plastic score [1]. An online collection of several works by composer Pall Ivan Palsson [24] or the website `animatednotation.com` by Ryan Ross Smith [26] display a wide range of different scores and approaches. Thereby animated scores use various techniques and styles and are created with various software. In animated notation, graphical attributes are not strictly mapped with specific sounds or actions. There are no symbols or a syntax. Although animated scores often share common features, for instance a 'play-head' that indicates the actual position within a scrolling score [20], none of these features are obligatory or generally valid. Basically each score looks different. On one hand this seems to be a deficiency. On the other hand this freedom is the bases for individual artistic and musical expression and the possibility to create new music [9, 19], just like in the 1960s.

SPECIAL FEATURES

1 Two Areas of Application

Let's take a look at two areas of actual application to show two major features of animated notation. The area where animated notation can demonstrate its intuitive applicability the best is education. *Dabbledoo Music* for instance is a project by Shane Mc Kenna and Kilian Redmond from Ireland [22]. They call it "a new multimedia experience for young musicians… It aims to encourage creative music making and group performance in a new and exciting way." [22] Various types of animated notation, varying from simple to complex ones, are used to encourage and educate children to improvise and compose within a structured framework. Thereby especially timing and interaction can be practiced without the necessity of learning a complicated notational system. Another interesting example is the artistic research project *Voices of Umeå* at Umeå University Sweden by Anders Lind. He utilizes *The Max Maestro*, a standalone application programmed in Max/MSP that features an animated notation which can be controlled in real-time [23]. A choir of musically untrained people is conducted via *The Max Maestro* to produce vowels and other sounds. The length of each vowel, dynamics and structure over time are indicated. It basically allows participants to perform prima vista. Thereby performers become a part of the real-time compositional process [23]. Again the intuitiveness and simplicity of the animated score, in relation to the high quality of the musical performance, is remarkable.

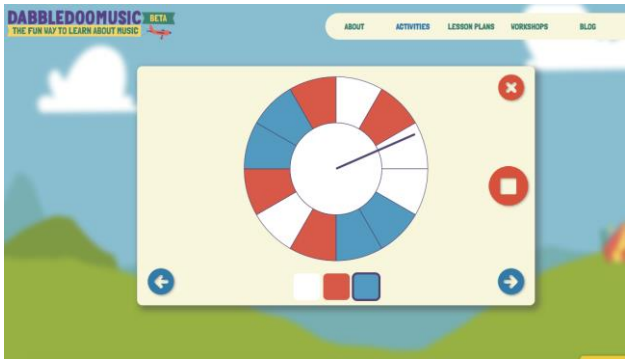

Figure 2. Screenshot of *Dabbledoo Music* website (beta version) [22].

A second area of application are musical genres or works that utilize alternative instruments, a mix of various instruments (like in live electronic music with acoustic and computer instrument) or are composed for indeterminate instrumentation. As there is no common practice, the notation of alternative instruments or objects can be accomplished on a very individual bases by the composer. For instance abstract computer sounds cannot be adequately represented in regular staff notation. By using abstract graphics, which can be mapped to musical parameters in a customized manner, animated notation can create a common ground, a kind of musical communication platform for all instruments involved [7]. Furthermore music like live electronic music is often improvised. Apart from offering a score that is able to generally structure and define musical improvisation, animated notation manifests usually in a video (file) and is therefore time-based media [2]. This allows especially to structure events accurately over time, and the score is as long as the piece. Hence, frequently used techniques like score following, stop watches or other means of triggering musical events and synchronizing acoustic and computer instruments, with their known drawbacks become obsolete.

2 Tackling a Typology

After examining the development of contemporary scores, composer and researcher Lindsay Vickery suggested four different types of what he calls screen scores. Namely scrolling score, permutation, transformative and generative scores [20]. Vickery's terminology was introduced in an historical context. Furthermore his subdivisions describe mainly the visual appearance of animated scores, like scrolling score, as the score actually scrolls. Additionally, in practice many scores mix techniques. They might not be described accurately by one of the four different types. Therefore this rather strict distinction is not truly useful for a categorization of animated scores. Still the used terminology proves very useful when discussing the appearance of animated notation in general. As mentioned earlier, the generative type is neglected in this paper.

A frequently used type of animated score is the scrolling score [20] (e.g. see figure 4). These kind of scores have several advantages. They support western reading habits as they scroll usually from left to right. These scores often work with a play zone or another indication that signals the performer which part to play. Many use a so called play-head, which is usually a line that graphics have to cross to indicate when to play them (see fig. 4). However, the most important feature of a scrolling score is the possibility to read ahead. Performers are of course used to this from staff notation. A lack of this feature might therefore cause considerable problems for musicians to utilize an animated notation [7]. Scrolling scores often utilize preliminary knowledge of the performers, for instance that a relative pitch height is indicated on the vertical axes.

Second, there are permutation or coherent scores, like for instance some Ryan Ross Smith's research studies [26]. These scores usually focus on the sequence of sound events and are therefore actional. Those scores appear as

circular shapes, like clocks, grids or other networks of (sometimes multilayered) objects, that change sequentially (permutation) over time and indicate precisely when and sometimes even how long to play. Often also the number of players is clearly indicated. Depending on the graphic design of the score, it is possible for the performer to read ahead (see fig. 2). Generally, these scores convey structure of events over time and not specific sounds. This allows them to be very precise regarding the sequence of events. If the sequences are not too fast, these scores could be even played prima vista by experienced musicians. Of course there are also other permutation scores where performers have clear instructions not only when to play, but also what to play. Then these scores can be regarded as the most accurate type of animated notations, where the least interpretational effort and least amount of improvisation for the performer is required.

Finally, there are transformative or morphing scores. They are usually highly associative in character. Graphics move on the screen or change their overall appearance from one distinct graphical object to another (e.g. morphing). Movements in any direction along X, Y and Z axes are possible. This does not allow performers to look ahead. Therefore these scores require profound involvement by the performer. Without further instructions or guidelines by the composer, these scores are musical graphics in motion in the sense of *December 1952*. Nevertheless it is possible to connect visual and musical attributes. For instance the overall appearance, the design of graphics, color, shape and of course the speed of the score can be mapped by the composer to convey specific sonic attributes.

When analyzing contemporary animated notations, various mixed types of the above mentioned appearances can be found. Furthermore, as there are no generally valid and commonly accepted rules for the design and use of animated scores, a strict categorization using Vickery's terms is difficult. Therefore I propose a three dimensional coordinate system, where scores can be positioned in a more flexible manner. For instance a scrolling score can be a rather associative score that works instructive and is actional. Or anything in between. Hence, this typology does not say anything about the visual appearance or the usability of the score.

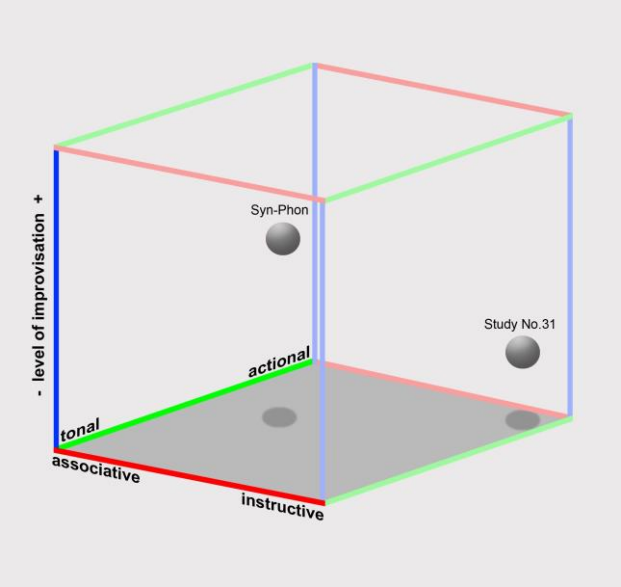

Figure 3. 3D-coordinate system to categorize animated scores. Example scores *"SYN-Phon"* and "*Study No.31"*

x-axes (red) : *associative - instructive*. This distinction refers to the appearance and possible interpretation of an animated score. A purely associative score can be regarded as a sheer trigger for improvisation, similar to a musical graphic. This means musical or acoustic parameters are not clearly mapped to graphical ones by the composer. What color, size or motion of a graphic indicate, is not defined. Rather the overall look and appearance of the score should influence the improvisation of the performer. An instructive score on the other hand indicates what to do and often precisely, when to do it. The score communicates instructions. The clock-like score on the *Dabbledoo* website (fig. 2) is a rather instructive score. The clock hand indicates when to play, and the color indicates the instrument group (red or blue) or a pause (white).

y-axes (blue) : *level of improvisation.* The position on the y-axes indicates overall how much improvisation is needed to perform the score. It is very likely that associative score requires a lot of improvisation by the performer. Nevertheless there are associative scores, where very few musical parameters are clearly mapped with graphical parameters. For instance performers simply play, when graphics are moving. On the other hand an instructive score can be very precise with certain parameters while other parameters need to be improvised.

z-axes (green) : *tonal - actional.* If not specified by the composer, the distinction between tonal and actional can be sometimes difficult. Tonal and actional refers to whether a graphic concerns sound or the means of execution. In other words, tonal graphics describe what to play, while actional graphics indicate when to play or what to do. Again the example of the clock in figure 2. This score is rather actional. The color refers to the

instrument group involved. For the music itself, shapes, colors and motion have no meaning. What to play is not indicated. The example *SYN-Phon* in figure 4 is tonal and actional. The red play-head indicates when and how long to play, while at the same time, for instance the white curvy line at the right side of the picture also indicates a kind of slow vibrato.

VISUAL COMMUNICATION PROCESS

The visual communication process describes how graphical elements (e.g. staff and notes on paper or motion graphics on the screen) are understood by the receiver (e.g. a violin player). Understanding the visual communication process of animated notation is crucial for understanding animated notation itself. Many problems derive of misconceptions and wrong expectations about how information, like playing instructions, are communicated in animated notation. An example : as mentioned in paragraph 2, avant-garde composers lost interest in graphic notation as they could not establish a new normative graphic canon. This loss in interest had several reasons that can't be discussed in detail here. However, one important point was exactly this misconception of the visual communication process. Avant-garde composers regarded graphic notation as the successor of regular staff notation [5]. Therefore they assumed that it would work the same way. However there is a disparity in the communication process of western staff notation and animated notation. Animated notation consists of abstract graphics or objects in motion. Usually it is a video or in other words moving pictures. According to visual communication theory, the logic of an image (or a video) is different from the logic of a text. It is not bound to a certain framework or rules. Therefore we cannot read and understand a picture in the same way as we would read and understand a text [13]. Pictures cannot be read. They can only be analyzed and interpreted. The more unspecific, unclear or abstract the image, the more sketchy and difficult the interpretation. In this context, there is no right or wrong interpretation as long as it is coherent and comprehensive. Surely scores in staff notation need also a certain level of interpretation. Still staff notation can be read. Similar to a text using words, one has to learn signs, modes and rules of staff notation first, to be able to read and execute them. Therefore the visual communication process of animated notation and the visual communication process of staff notation work entirely different. In consequence, avant-garde composers were disappointed of the potential of graphic notation regarding the "storage" of a musical idea, because a score could be interpreted in so many different ways. Their desire to establish a new normative canon had to remain unfulfilled.

German communication theorist Heinz Kroehl, discusses sign systems and visual communication in connection to semiotics and the theories of Charles Sanders Peirce [14]. According to Kroehl there are three major communication systems : Art, everyday life and science [11]. The everyday life system refers to real objects that surround us. It is not applicable when discussing music notation. Things have a name and we can assume that we are understood by others if we use the right name for the right object. When I say "bread", everybody, capable of English language, will know what I mean. In the scientific system, signs refer to definitions and rules. Staff notation consists of a system of specific rules, syntax and modes that need to be learned and understood to be able to apply them for musical performance. In other words, there is a (pre-)defined connection between sign and sonic result. This connection was shaped through the centuries, from neumes in the early middle-ages to western staff notation, that we know and use today. Someone able to read staff notation knows exactly which key to press on a piano keyboard when reading a specific note in a score e.g. a C4. Another musician reading the very same score will therefore press exactly the very same key on the piano keyboard when reading C4. To interpret this C4 as a completely different pitch and therefore pressing any key apart the C4 would be regarded as wrong. Therefore the transfer of knowledge, the visual communication process in staff notation can be called scientific according to Kroehls distinction [11]. Animated notation works entirely different. The interpretation of one graphic could sound different every time it is performed. Opposite to staff notation, animated notation operates in the artistic system [11]. The artistic system conveys possibilities. It is not possible that two people, in our case musicians, interpret or understand a graphic in exactly the same way and thus play identically. An animated notation is an invitation for composers and performers to start their own so called mapping process. They need to connect or map visual attributes with sonic attributes. In staff notation the mapping by composer and performer are basically congruent. In animated notation the mapping process is done individually, first by the composer and then by the performer.

It is important to understand the peculiarities of animated notation in the visual communication process to be able to comprehend its advantages and disadvantages as a tool for composition. Animated scores are intuitively applicable. Any musical parameter, like pitch, dynamics or even timbre and any other playing instruction can be conveyed. Animated notations can be simple and utilized by children and musically untrained people. On the other hand, animated scores can be quite sophisticated and require experienced and skilled musicians. The

advantages of animated notations are at the same time the reasons for its drawbacks. This type of notation cannot store music in the way staff notation does. It is not possible to communicate distinct pitches, harmonics or rhythm in a way that they can be repeated in a similar manner in each performance. Still animated notation is music notation. It does not lead to a random performance or purely free improvisation. The composer defines the limits. Animated notation is simply a different approach to music composition and interpretation.

1 Design, Mapping and Guidelines

The design of the score is of course a crucial part that requires some knowledge in graphic design and motion graphics in order to be able to compose and not „to be composed“ by a software. In other words, it is possible that a lack of experience and limitations of a certain software have a significant impact on the design process of a score. This influence should be strictly avoided. However, the major difficulty in animated notation is the connection or mapping of visual and musical parameters [7]. Most musicians are used to western staff notation. For them it is clear how notes should be interpreted. But how does a red square sound compared to a green triangle? As described before, there cannot be a clear answer to that as animated notation communicates artistically. As mentioned already, animated notation needs to be interpreted and this interpretation might vary. This leads us to the mapping process. Clef, key, lines, bars and notes indicate precisely what (e.g. pitch) to play. In staff notation the major mapping process has been done already as it relies on a set of specific universally accepted rules. In graphic and animated notation meaning needs to be created individually by interpreting graphics. The mapping processes, describes the creation of meaning by connecting graphics and graphical attributes with sounds and sonic attributes. This process is divided in two separate steps. First step is the mapping done by the composer (c-mapping). The composer tries to create a score, which allows comprehensible connections between graphics and sounds or graphics and actions. Comprehensibility is the key. It is advisable to build up on previous knowledge and commonly accepted relationships. For instance western color coding, the Cartesian coordinate system with pitch on the y-axes and time on the x-axes, connecting the size of graphics with musical dynamics or utilizing the inherent motion of graphics on the screen for displaying a phrase or motive. Second step is the more delicate mapping done by the performer (p-mapping). Now, the performer interprets the score and tries to find connections between the visuals and playing music. P-mapping might vary significantly from c-mapping. However, the more precise, distinct and comprehendible the c-mapping, the more definite the score and the less interpretation work (and improvisation) by performers is required. The p-mapping can be also supported using additional guidelines. In those guidelines the composer talks about the work itself, clarifies how to read the score, explains the meaning of certain graphics or offers other means to facilitate the interpretation and mapping process for the performer. For instance one major distinction that can be made by composers and that contemporary notation struggles with for quite some time (however in a slightly different context [17]) is the distinction of graphics in either tonal or actional types. Tonal means the graphics convey sound characteristics. They refer directly to the sound and its acoustic parameters. Actional concerns the means of playing or execution. Actional graphics do not convey what to play or how it should sound but what to do or foremost when to play. Another possibility is to map instruments to a certain color. Like the design of the score, the use of additional guidelines or other explanations is of course completely up to the composer.

2 Two Examples

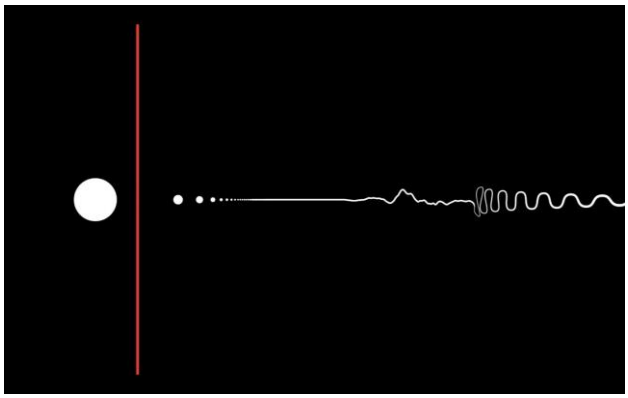

Figure 4. Screenshot of a scrolling score *SYN-Phon* by Candaş Şişman featuring a red playhead [25]

SYN-Phon by Candaş Şişman [25] (see fig.4). On Şişman’s website you will find a video of the score with a recording of a performance. There one can hear one possible interpretation of the score. *SYN-Phon* is a scrolling score, featuring a red play-head. The instrumentation is trumpet, cello and electronics/objects. Şişman himself calls it a graphical notation. White graphics on a black background scroll from right to left indicating when to play and what to play. These graphics are tonal and actional graphics at the same time. The X-axes is clearly indicating time, while Y-axes is indicating a relative pitch. There is no clear indication within the graphics that refers to a specific instrument. Therefore it is up to the performers to decide who plays certain graphics or parts of the score. The image in figure 4 shows the very beginning of the piece. The big white ball that just passed the play-head, was interpreted as a

presumably electronic, gong-like sound while the smaller dots that follow are short strokes by the cello that become a continues tone changing pitch according to the curves of the line. Later the score displays several different types of objects at the same time. They are interpreted by different instruments. When watching the video on Şişman's website one can state that the score generally works very accurately regarding the structure of events over time. The mapping of visuals and music also works out well. Most graphics find a comprehensive acoustic equivalent. What can be a little distracting sometimes is the inconsistency of the mapping. For example, some uniquely defined graphics (dots connected with thin lines) are played by the trumpet and the live electronics. The cello repeats similar playing techniques and sounds although the graphics look quite versatile. Furthermore performers do not interpret graphics consistently. The snake like line on the very right in figure 4 is played by the cello as a tone, slowly rising and falling in pitch. Visually, the interval modulates around a kind of center frequency and should be larger in the beginning of the snake. While at the end the interval should be smaller. In the performance, the cellist plays the interval modulating around a rising center frequency, which does not correspond properly to the visuals. It could be discussed whether this is a misinterpretation of the score by the performer, or whether it is unprohibited by the composer to interpret the score more freely, though.

Study No. 31 for 7 triangles and electronics by Ryan Ross Smith [26]. This piece belongs to the permutation/coherent type and comes with few explanatory guidelines by the composer. There are seven imaginary circles with cursors that indicate which part to play. One cursor/circle for each triangle player. Each circle features four attack/mute event nodes connected by an arc. The graphics are actional as they indicate when to hit a triangle and how long it should ring. The nodes and the arcs change over time. A standalone Max/MSP patch is triggered by the score. It records the triangle sounds, manipulates them and plays them back automatically. Hence, there is no need to indicate the live electronics in the score. The animated notation hardly requires any interpretational work by the performers. The way the score is designed indicates directly that the piece is about structure or patterns respectively. The patterns change over time while the overall form of the piece remains the same. The score is very intuitive. With very few explanations even musicians with limited skills are able to perform the work in a satisfactory way. Since the score is instructive, the graphics are actional and not much improvisation is demanded, the score constitutes a kind of minimal music approach that unfolds vividly how simple and precise animated notation can work.

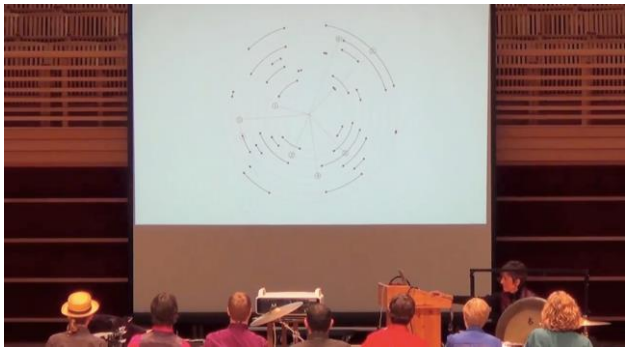

Figure 5. Screenshot of a performance documentation video featuring the score of *Study No.31* by Ryan Ross Smith [26]

CONCLUSIONS

Animated notation is an alternative approach to contemporary music composition and performance. Its intuitive applicability and the possibility to notate any kind of sound source or non-musical instruments are the major advantages of this kind of music notation. However, the visual communication process, meaning the transfer of a musical idea in general and of playing instructions in particular, is significantly different from regular staff notation. Animated scores cannot be read, they can only be interpreted. And this interpretation might vary significantly. Composers have to understand these differences to be able to utilize the advantages of animated notation. The future development of hardware and software will surely influence the evolution of animated notation and the possibilities to interconnect it to other techniques. As a creative tool, it has by no means reached its limit, yet. There is still a lot to research and to explore in the field of animated notation.

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