

A Study of Two Thereminists: Towards Movement Informed Instrument Design

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ABSTRACT

This paper presents a comparison of the movement styles of two theremin players based on observation and analysis of video recordings. The premise behind this research is that a consideration of musicians' movements could form the basis for a new framework for the design of new instruments. Laban Movement Analysis is used to qualitatively analyse the movement styles of the musicians and to argue that the Recuperation phase of their phrasing is essential to achieve satisfactory performance.

Keywords

Effort Phrasing, Recuperation, Laban Movement Analysis, Theremin

1. INTRODUCTION

A decoupling occurs in the design of a new digital music instrument (DMI) due to the freedom of not having to match physical exertion to driving energy. The instrument can be viewed as being composed of distinct interconnected parts such as the interface, mapping, sound engine, and sound reinforcement. This decoupling has been the focus of much research in terms of the opportunities it affords and also in terms of problems that arise for the instrumentalist and audience when the relationship between gesture and sonic result is obfuscated or removed.

In a 'traditional' acoustic instrument, the physics of the sound production provides a guiding framework within which the instrument design evolves. The excitation of a string, the physics of a standing wave in a column of air, these physical realities force their influence upon the instruments overall physical realisation, its size, where the valves and buttons are positioned etc. In the design of Digital Musical Instruments (DMI) this framework is absent.

Many different approaches to DMI design are evident in the literature. The field of tangible interface design points towards the notion of physicality in the interface particularly when contrasted with standard mouse and keyboard paradigms for computer

control [1]. Other designers look towards HCI for a framework to base the design process on. Design practise may be informed by ergonomics with a task based view of instrumental performance and an associated desire to reduce the effort required by the performer to complete a musical task [2]. Ryan and others however have pointed towards a notion of desirable effort in instrumental performance, expressing a view that an integral part of expressive musicianship stems from the struggle with the instrument in the creation of the sound, "Though the principle of effortlessness may guide good word processor design, it may have no comparable utility in the design of a musical instrument. In designing a new instrument it might be just as interesting to make control as difficult as possible. Physical effort is a characteristic of the playing of all musical instruments." [3]

The notion of introducing physicality by making 'control difficult' is one that has been explored in several new interfaces [4]. As previously described by the first author the GSpring can be seen in this vein [5]. This approach however trivializes the complexity of human expressive movement. Simply requiring more force for a given result does not necessarily engender a more expressive performance. The Theremin for example is an instrument that at first consideration would seem to require little force in its performance due to its 'hands free' non-contact interface. It does however allow for rich expressive movement as part of its performance. Clearly there is something else to this notion of effortful performance than merely the requirement for physical exertion. As Waiswicz indicates in his comments regarding effort and expression, "In the early eighties I formulated thoughts about the importance of forcing the performer to apply physical effort when playing sensor instruments. I assumed that also this effort factor was crucial in the transmission of musicality through electronic instruments. Now I think the crucial aspect of perceived musicality is not the notion of effort itself, but what we feel and perceive of how the physical effort is managed by the performer." [6] The term 'managed' is key here. It invokes an acknowledgement of the temporality of movement; that movement unfolds in time and that therefore to consider musical performance is to consider how the performer's movements unfold over time. Analogous to the musical idea of phrasing we must consider how the performer phrases their movement and how this correlates with the musical result if we are to enquire into the nature of effortful musical expression. What are the qualities that establish a certain relationship between movement phrasing and sonic phrasing as desirable? It is our belief that a better understanding of these qualities could inform the design of

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new DMI's that allow for the visceral physicality of performance visible on acoustic instruments without being simply mimetic.

As a starting point in our enquiry into the nature of physicality in musical performance this paper presents an analysis of two musicians' theremin performances and attempts to draw from these observations lessons that may inform the design of new instruments. Our premise is simple: when playing a musical instrument, the human performing artist needs to use their body in order to allow an expressive musical process to occur. Therefore in designing a new musical instrument, we need to take this premise into account and design instruments that allow for – perhaps even invite – expressive human movement in the production of the sound.

In our performer observations Laban Movement Analysis (LMA) is used as a qualitative framework for the description of this movement. In particular we focus on one concept taken from the Laban framework, Exertion/Recuperation and its role in movement phrasing. All terms that are part of LMA are capitalized. Within LMA these terms have specific defined meaning.

2. BACKGROUND

The study of musicians' movement is a well explored area of research within the field of NIME seeing much concentration on attempts to classify musicians' movement in terms of gesture types [7]. On the quantitative level, motion capture has been used to study the ancillary gestures of clarinetists [8]. Laban Movement Analysis (LMA) has been applied to provide a qualitative description of clarinetists' ancillary gestures [9]. Elsewhere Laban's theory of Effort, which constitutes part of the LMA framework, has been used to investigate the impact of dynamic resistance modulation on performer's movement [10]. Since it is the musician's body movement that produces the sound from the instrument, we believe that qualitatively observing and describing the body's movement both in conversational and in performing situations can give us an understanding of how that performer produces his/her expressivity while playing.

2.1 Overview of LMA

A full description of LMA is beyond the scope of this paper. Here we present a general overview of the framework and explain the background to Effort phrasing in particular Exertion/Recuperation.

LMA provides a rich overview of the scope of movement possibilities. The basic elements of Body, Effort, Shape and Space (BESS) can be used for describing movement and providing an inroad to understanding movement. Every human being combines these movement factors in their own unique way and organizes them to create phrases and relationships which reveal personal, artistic, or cultural style [11].

An important distinction between LMA and other forms of movement description is that LMA describes the movement of the body in qualitative terms – not in aesthetic, quantitative or anatomical terms. It is the qualitative aspect of movement that is the key to describing and therefore understanding expressive non-verbal communication. If we are describing a businessman losing his temper at a board meeting and we say, "His arm traveled downwards until his closed hand came to the table" (a quantitative or mechanical description of an action) we have no sense of how

the gesture expressed his fury. If we say "He brought his fist down onto the table with a diminished Punch – Strong, Quick, Direct" – we have a better idea of the expression. Equally, if we saw the gesture - an arm coming down with a clenched fist toward the table – done with that Strong Quick Direct Effort quality, we would not have to hear the words, nor would the hand even have to hit the table in order to see and interpret the expression of the gesture as angry. If the hand came down (clenched or not) with Light, Free Flow, Sustained we would probably not interpret it as an angry gesture. The expression in the communication comes through the quality of the movement. This is an example of Effort. The Body, Shape and Space are also informative of the individual's movement patterns in other ways. It is assumed that each individual has their own movement preferences in all four categories of movement and that these preferences are recognisable aspects of that person's personality and expressive style.

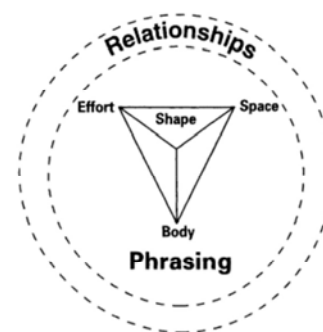


Figure 1 Basic Elements of LMA [12]

An aspect that we feel is of particular interest in studying musicians' movement is how Efforts are sequenced together. Laban emphasised the role of rhythm in manual work which lead to the development of his concept of phrasing in movement. This was particularly evident in his work with Lawrence on the movement of factory workers in wartime Britain. In this situation Laban's remit was to alleviate strain and dissatisfaction amongst conveyor belt based workers in factories. Prior to this 'time and motion' studies had been used to minimize the amount of movement required for a particular job in the belief that this approach would maximize productivity. Laban however emphasized the need for full body movement as part of any process to alleviate strain and through his Effort system developed movement training programs for workers that allowed for Recuperation as part of the production process. He emphasized the correct phrasing of Efforts to allow for Recuperation following Exertion. In this way workers were able to minimize strain, enjoy their work more and work for longer. [13]

Many movement observers [14][15][16] have developed Laban's concept of phrasing, or what he originally called "rhythm" in their work. Peggy Hackney defines phrases as perceivable units of movement which are in some sense meaningful. They begin and end while containing a through line [17]. Irmgard Bartenieff was particularly interested in how a well-phrased movement was simultaneously more expressive and more functionally effective: "Thus, it is not just the activity that identifies the behavior but it is the sequence and phrasing with their distinctive rhythms that express and reinforce verbal and emotional content." [18] Maletic

comments on a particular basic training exercise that Laban used: "Its characteristic sequence is a rhythmic chain of a preparatory swing (Anschwung) followed by a main swing (Aufschwung) and its expiration which can coincide with its re-initiation." [19]

Practitioners using the concept of a phrase of movement have divided it up in various ways. Hackney depicts this graphically:

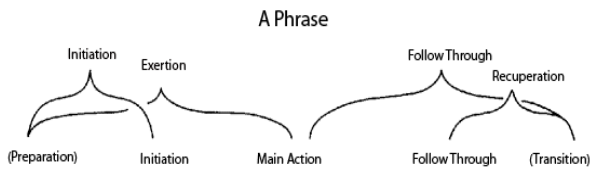


Figure 2 Phases of Phrasing [20]

2.2 Phases of Phrasing

In LMA a movement is commonly seen as being organized into three sections: a Preparation phase that may overlap with the initiation phase, a Main Action and finally a Recuperation or follow through phase that may resolve into a transition and subsequent preparation phase for the next action. Here we use the idea that a phrase has three phases: Preparation, Main Action, and Recuperation.

2.2.1 Preparation phase:

In order to do any physically demanding or complex task, we see an individual prepare themselves: whether it is the ballet dancer before a pirouette, a pole vaulter about to run or a new graduate about to go into a job interview. The body prepares as the mind (ie the focus, concentration) prepares for the task. "It is in the preparation moment that we claim our intention. Intention patterns the organism." [21]

2.2.2 Main Action

The main action is that which is most connected with the sound produced and will vary according to the individual's style and understanding of what they are doing. In terms of playing the instrument the main action can often be associated with the excitation phase of the movement.

2.2.3 Recuperation

"After the Main Action happens, there is generally a natural change of movement quality which allows the mover to recuperate from the exertion of that action." [22] Whether this Recuperation is letting the breath out after a tense or high energy interaction or the follow through of a tennis serve in which the Flow quality goes from Bound to Free, the individual needs a recovery from their Main Action. This recovery may be described in any of the movement categories but will be as individual and unique as the rest of the performer's movement style.

We propose that the ability to recuperate and prepare as part of the performed movement is essential for the musician if they are to access their expressivity: if the performer is unable to recuperate, the flow of their performance which is the vehicle for expression is disrupted. It must be emphasized that Recuperation need not necessarily be a moment where no sound is produced or control of the instrument is relinquished. Further, the ability to recuperate can be seen as a function of several things, the movement repertoire of the performer, the affordances of the instrument and the score or musical goal.

3. MATERIALS AND METHODS

3.1 Choice of material

These observations are taken from a DVD produced in 1998 by Moog Music Inc called *Mastering the Theremin* [23]. Two Theremin players, Lydia Kavina and Clara Rockmore, demonstrate, discuss and perform pieces on the theremin. A movement analysis of the two women has been carried out using both formal performance and informal interactive situations. In the case of Clara Rockmore three different situations were analysed: firstly a social gathering discussing the theremin with her sister and nephew at her apartment, secondly a demonstration of theremin performance technique where she explains the basics of performing with the instrument and finally her performances of three pieces accompanied by her sister on piano. In the case of Lydia Kavina we analyzed six lessons given by her to camera and four performances. The performers were chosen as they are both considered experts on this instrument. The availability of footage showing the two performers both in and out of performance was a requirement for the study as we wished to be able to compare both styles in as wide a context as possible. We were also interested in observing their individual movement patterns of phrasing in different situations.

3.2 Analysis Method

Each section of the DVD described above was observed on four different days over a period of a month. Each observation session lasted between two and four hours. Three other Laban Movement Analysts were consulted on an informal basis to compare observations. All four categories of BESS were used in order to establish some understanding of the differences in the performers' movement styles before focusing on their respective Recuperation phase of phrasing.

3.3 Results: Comparison of Performances

Here we will give a brief overview of each performer's movement style in order to set their respective Recuperation styles in the context of their overall phrasing.

3.3.1 Lydia Kavina's Movement Qualities

Lydia has a preference for the Vertical Plane, Light Effort and a wide range of Free and Bound Flow, some Shape Flow with Quick or Sustained Efforts. She tends to Prepare with a Shape Flow Widening and Lightness of the upper torso seen clearly as she lifts her elbows to the side. (A clear example of this takes place at the beginning of Swamp Music) Her Recuperation tends to be a Light Free flow gesture of the right arm often accompanied by a Postural Shift of the body stepping back or to the side of the instrument. For example at the end of lesson 4: [24] she finishes playing "Somewhere Over The Rainbow" with a Light Free Flow gesture of the right arm before she turns off the instrument and steps back from it. We see variations of this pattern throughout her demonstration: sometimes she simply drops her arms in Passive Weight and Shape Flow, sometimes she does the more active Recuperation of a large Kinesphere Gesture with Free Flow.

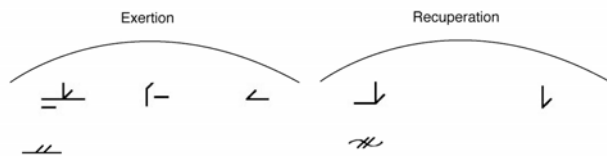


Figure 3 Lydia's Effort Phrasing

3.3.2 Clara Rockmore's Movement Qualities

Clara has a preference for the Sagittal plane and she uses Quickness, Direct Focus (Space Effort) and Bound Flow in her personal movement repertoire. Her Bound Flow and use of Carving Mode of Shape Change while playing is the hallmark of her performing movement style; her face (in particular, her eyebrows) is often where the expressiveness of her playing is most evident. Her Recuperation is almost a collapse; as we see at the end of Hebrew Melody she steps back from the instrument and drops her Focus, Flow and Sagittal stance.

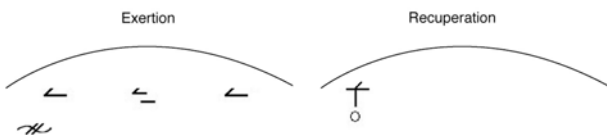


Figure 4 Clara's Effort Phrasing

4. DISCUSSION

Laban's theory emphasizes the importance of phrasing in movement, "a movement makes sense only if it progresses organically and this means that phases which follow each other in a natural succession must be chosen" [25]. For the performer of an established instrument the ability to evolve phases that can be efficiently sequenced develops as part of the learning process. Laban's theory of phrasing in this context emphasizes that the ability to find sequences of movement that allow for preparation, action and Recuperation is key to the development of musicianship. It must be noted that the Recuperation from one action may also form the preparation for the next action and that Recuperation may be active in that sound is produced during this phase.

In terms of phrasing Clara does not seem to have much visible preparation or recovery. The camera often does not let us see the moment before or after she performs so we are making assumptions based on observations made of her in social interaction and demonstration of the theremin. Her preference for Flow variation at the Bound end of the continuum seems to allow her to play the instrument with almost no Preparation or Recovery. She comes from and returns to a Neutral or Bound Flow state which seems to allow her to Prepare or to Recuperate without a high degree of variation in the Efforts used.

Lydia's Recuperation of a large Kinesphere Gesture with Free Flow is notable in that the instrument would not allow such an amount of Free Flow or large looped movement while playing the piece; it is interesting to speculate that she incorporates these qualities into her Recuperation because they are part of her personal repertoire and she needs to return to them in order to Recuperate from the Exertion of playing the piece. Both these performers return to at least one Effort in their Recuperation Phase that is present in their Preparation and in their personal

movement style: Bound Flow in the case of Clara Rockmore, Lightness in the case of Lydia Kavina.

With all of this observation, our belief is that, within the demands of the task, the individual must find their own way of playing the instrument; 'matching' so to speak, their individual movement style with the technical demands of the task. In terms of the Theremin, the design of the instrument dictates a set of demands that are very specific: due to the effect of body proximity on tuning the performer must remain quite still except for the arms and hands: in Laban terms, Bound Flow, spatial accuracy through Direct Space Effort, a held torso and head and prescribed weight shifts are encouraged for the performance of tonal music. Despite these limitations, both Clara and Lydia find very individual ways of playing the Theremin. In the context of NIME we feel this point highlights the importance of considering not just the range of movement sensed and used directly by the interface but also the range of movement that is left free to the performer.

In his work with industry Laban emphasized the need for Recuperation in order to avoid strain. In musical performance the degree to which a performer may recuperate may be seen to impact upon musical tension. Composers for voice and wind instruments do so with an understanding of the need to breathe. In considering the need to recuperate we see three interrelated factors: the movement phrasing available to the musician developed through the attainment of musical skill and personal movement preference, the movement requirements of the instrument by virtue of its physical realization and mapping structure and the particular requirements of the score or performer's intention. In seeking to use movement as an interaction design element the designer must address the interdependence of these three factors.

An understanding of the relationship of movement phrasing and sonic phrasing evident in many acoustic instruments may be used to inform the development of a higher order mapping system as part of a new instrument. We believe that focusing on this relationship can inform the process of creating new interfaces for musical expression that seek to leverage the notion of effortful interaction exemplified by many acoustic instruments whilst avoiding a purely mimetic approach. Further a consideration of the availability for Recuperation provided by the instrument may be used to allow for the creation and resolution of musical tension in music composed for the instrument.

The theremin interface can be seen simply as two proximity detectors mapped to pitch and volume respectively. In the context of tonal music we observe this simple mapping of distance to pitch as encouraging a correlation between the LMA element of Flow, which ranges from Free to Bound, and pitch articulation ranging from glissando to staccato. This however need not be the case for non-tonal music highlighting the requirement to have a musical goal in mind as part of the instrument design process. For the designer of a new instrument a consideration of movement phrasing in the context of musical outcomes could form the basis for a new design that leverages the enjoyment of expressive movement rather than seeks simply to minimize effort.

5. CONCLUSIONS AND FUTURE DIRECTIONS

In this paper we have drawn on the Effort theory of Rudolph von Laban and the related discipline of LMA in an enquiry into what might constitute effortful performance on new interfaces for

musical expression. Though LMA has been applied to the analysis of musicians movement in NIME before an aspect that has up until now been ignored is Effort phrasing. Here we have particularly focused on Recuperation as part of phrasing, hypothesising that the degree to which the performer may recuperate influences the perceived musical tension. We have highlighted the factors which influence the Recuperation phase, the instruments realisation, the musical goal and the performers skill, in the belief that an early consideration of the interdependent nature of these three factors can inform the design of a new interface.

Specifically we have presented an analysis of two thereminists movement. We have focused on the manner in which they Recuperate following the Exertion of playing the instrument. Our analysis shows that each performer has a different style of Recuperation and we have demonstrated the utility of LMA in qualitatively describing this difference.

In our analysis of Recuperation presented here we have focused on the Recuperation evident as the performer finishes a piece or takes a rest as the accompanist carries the music. Future work will seek to focus LMA's theory of phrasing on musicians movement looking at how the performer phrases their Exertion and Recuperation whilst actively playing and seeking to correlate this with perceived musical tension.

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