The Organ: A Dangerously Inexpressive Musical Instrument?

By Alan G. Woolley

Abstract

Whether mechanical organ actions allow organists to control the way in which they move the key and thus influence the transients has been discussed for many decades, and this is often given as their main advantage. However, some physical characteristics of mechanical actions, notably pluck, make it difficult for the player to control the key movement and thus vary the transient. This project looks primarily at how organists use rhythm and timing to play expressively, but also provides some evidence about whether transient variation is significant. Rhythmic variation can be through the use of deliberate “figures”, or the player may be unaware that they are making such variations. These variations in style lead to clear groupings of the pressure rise profile under the pipe and thus limit the amount of transient control possible. This is supported by informal listening tests. It also considers other factors that might lead to transient variation that are outside the player’s direct control.

Introduction

This paper presents results from a project funded by the UK Arts and Humanities Research Council at the University of Edinburgh and is based on papers presented at ISMA 2010 (International Symposium on Musical Acoustics in Australia) and Acoustics 2012 in Nantes. The organ has been described as a “dangerously inexpressive” musical instrument. The project set out to investigate the extent to which organists use rhythm and timing to achieve expression on mechanical action pipe organs rather than varying the transient by the way in which they move the key, although it inevitably also considered the latter. Transient control is widely considered a basic factor of organ playing, but this is not universal, and a number of prominent organists and builders, such as Robert Nocher, disagree. However, there is little published research about this or whether other mechanisms may be important for expressive organ playing.

This project originally started because the PhD work that preceded this or whether other mechanisms may be important for expressive organ playing. The need to keep the playing force and repetition rate within acceptable limits means that the action can never be made completely rigid, and it will always act like a spring to some extent. The basic characteristics of the movement of a key through to the sounding of the pipe are illustrated graphically in Figure 3.

The low frequency variation in the pressure at the beginning of the note is due to the delay of the pressure regulator, described more fully later, and the high-frequency component throughout is due to the pipe feeding back into the groove. The most important features of Figure 3 are:

• The key moves a significant distance before the pallet starts to open and catches up with the rest of the action ~ 40%
Pipe organ mechanical action

Figure 5. Graph comparing the same notes from two performances of the same sequence but with one accented by being “hit harder” (light blue). Ahrend organ, Reid Concert Hall, University of Edinburgh

- The key slows down due to the increasing resistance as the action flexes (rollers twisting, washers compressing, levers bending, etc.)
- As the resistance due to pluck is overcome, the key increases in speed of movement, as it is not possible to reduce the force being applied by the finger in the time available.
- The air pressure in the groove starts to rise at the same time as the pallet starts to open.
- The force applied to the key increases until just after the pluck point, when it reduces, although not suddenly. This is probably due to the airflow through the pallet opening applying a closing force to the pallet.
- The force increases suddenly as the key hits the key bed.
- The air pressure reaches a peak early in the pallet movement (after about 45% pallet travel).
- The pallet starts to open at about 40% of key travel and the pressure in the groove reaches a maximum at about 57% key travel. This is the only part of the key movement that could affect the transient, but during this movement the pallet is out of control of the key because it is still catching up with it.
- There is a delay before the pipe starts to speak.
- The key is on the key bed and the pallet is fully open before the pipe has reached stable speech.
- There is a delay before the pallet starts to close when the key is released (probably due to friction).
- Later in the release movement the pallet starts to close in advance of the key movement (due to air pressure).
- The pallet is firmly seated before the key has returned to its rest position (in this case the key has 23% travel to go).
- The sound envelope does not start to diminish until the point at which the pallet closes.
- During the key release, the force is gradually reduced but the key does not start returning until the force due to the pallet spring is greater than the force applied by the finger.
- There is slight increase in force as the pallet “snaps” shut due to the flow of air through the opening. This helps to reduce leaks around the closed pallet, but would also make it very difficult to control the pallet in the final stage of travel.

The time of travel of the pallet from starting to open to fully open is typically around 30ms (0.03 seconds). Reaction times in sporting events are generally around a best of 100ms. This implies that the player is unlikely to be able to respond to pluck and reduce the force being applied by the finger.

These effects were noted in every organ measured, to a greater or lesser extent, depending on the size and rigidity of the action and the magnitude of pluck, and even on a light, suspended action the effect is significant.

Initial work

Some tests were carried out with the University of Edinburgh organist, Dr. John Kitchen, playing the 1978 Ahrend organ in the Reid Concert Hall. This has a very “light” suspended action (50g key force, 50g pluck, Hauptwerk, middle C Principal). In the first exercise he played an improvised theme and was then asked to repeat it, varying nothing but the speed of key movement. The measurements of the key movements are shown in Figure 4, in which the curves are superimposed on the main part of
the key movement rather than the pluck point. Kitchen felt that he had moved the key “five times faster” the second time (black curve) and changed nothing else. In fact, the time from the key starting to move to hitting the key bed in the fast note was about half the length of the slow note, with all of the difference at the beginning. Figure 4 does not show that the overall tempo was also faster with the fast key movement, but it can clearly be seen that the fast attack has resulted in a significantly shorter note. Even on this relatively rigid action, the effect of pluck is apparent at the beginning of the key movement at about 0.8mm key travel.

In the next exercise Kitchen tried to accent a note by “hitting it harder.” Figure 5 shows that again with the non-accented movement the effect of the flexibility of the action is apparent, but the majority of the movement is very similar in both cases.

In the two previous examples, the main part of the key movement has been superimposed. Since the relative timing of the pluck point varies, a further test was designed to indicate the point at which the player perceived the note to start. He was asked to play in the two manners from Figure 4 one octave apart simultaneously. Figure 6 shows the two notes to the same time reference and indicates that the player perceived the start of the note to be the point at which the key started to move. This introduces a timing difference between the two notes of approximately 30ms as the pipes will not start to speak until after the pluck point at a displacement of approximately 10% of travel. The “slow” note will sound after the “fast” note and is also slightly longer by about 10ms. The differences between the shapes of the beginnings of the key movements are discussed later. It is interesting that the notes do not end simultaneously.

A further exercise was carried out at the Canongate Kirk in Edinburgh (Frobenius 1998, IIP20). A simple visual examination (confirmed by informal listening tests) shows that distinctly different key movements are not reflected in the sound profiles. Figure 7 represents a “fast” attack and Figure 8 represents a “slow” attack as perceived by the player. As observed throughout, the “slow” attack also resulted in a longer note.

**Rhetorical figures**

A frequent comment by organists was that even if it were possible to vary the way that they moved the key at the start of a piece of music, it was not possible to maintain these variations throughout a piece. Dr. Joel Speerstra is studying rhetorical figures at the University of Göteborg, based on his research into clavichord technique. These are physical gestures that can be maintained throughout a performance and are based on rhetorical figures in German baroque music described by Dietrich Bartel. Examples of Speerstra’s figures are listed below with his descriptions, along with graphs of some of these showing the key movements, pallet movements, pressure rise in the groove, and sound recordings. The measurements taken showed that phrasings closely followed the descriptions given, and some examples are shown below.

**Transitus (Figure 9)**

“You are standing a certain amount of the weight of your arm on a stiffened finger with a relaxed elbow, and moving from the first finger to the second without completely engaging the muscles of your arm that would lift it off the keyboard. This technique makes it easy to control heavy actions, and you would expect this kind of paired fingering to have fast attacks for both notes and a

---

**OUR LADY OF REFUGE, BROOKLYN KILGEN PIPE ORGAN RESTORATION**

Dedication Recital by Olivier Latry from Notre-Dame Paris

**OCTOBER 18, 2013 at 7PM**

WWW.THEDIAPASON.COM

THE DIAPASON  OCTOBER 2013  25
Pipe organ mechanical action

longer first and third note a shorter second and fourth note and, hopefully, as slow a release as possible after the second and fourth note.”

The releases of the second and fourth notes are not significantly different from the others.

Suspiratio (Figure 10)

“It is a figure that starts with a rest followed by three notes, so the first note is now an upbeat, and I would expect that there is a faster release after the first note, and the second and third would form a pair much like the first and second in the transitus example.”

Portato (Figure 11)

“Portato [uses] separated notes but with slower attacks and releases.”

To these can be added more familiar styles such as legato and staccato, although these may benefit from being more clearly defined. Whenever players were asked to play fast attacks, they also played shorter notes.

Measurements were made of Speerstra playing in these styles on the North German organ in the Örgryte Church in Göteborg (built in the style of Arp Schnitger by the Göteborg Organ Art Centre [GOArt] as a research instrument). The key movement (middle C, D, E, F), pallet movement (C, D) and pressure in the groove of middle C (measured by removing the Principal 8′ pipe) were measured, as well as sound recordings being made. All magnitudes are to an arbitrary scale.

Figure 13. Key and pallet movements, pressure in groove and sound recording of a note played using the Portato Rhetorical Figure

Figure 14. Key and pallet movements, pressure in groove and sound recording of a note played using the Transitus Rhetorical Figure

Suspiratio (Figure 10)

“It is a figure that starts with a rest followed by three notes, so the first note is now an upbeat, and I would expect that there is a faster release after the first note, and the second and third would form a pair much like the first and second in the transitus example.”

Portato (Figure 11)

“Portato [uses] separated notes but with slower attacks and releases.”

To these can be added more familiar styles such as legato and staccato, although these may benefit from being more clearly defined. Whenever players were asked to play fast attacks, they also played shorter notes.

Measurements were made of Speerstra playing in these styles on the North German organ in the Örgryte Church in Göteborg (built in the style of Arp Schnitger by the Göteborg Organ Art Centre [GOArt] as a research instrument). The key movement (middle C, D, E, F), pallet movement (C, D) and pressure in the groove of middle C (measured by removing the Principal 8′ pipe) were measured, as well as sound recordings being made. All magnitudes are to an arbitrary scale.

Figure 13. Key and pallet movements, pressure in groove and sound recording of a note played using the Portato Rhetorical Figure

Figure 14. Key and pallet movements, pressure in groove and sound recording of a note played using the Transitus Rhetorical Figure

Measurements were made of Speerstra playing in these styles on the North German organ in the Örgryte Church in Göteborg (built in the style of Arp Schnitger by the Göteborg Organ Art Centre [GOArt] as a research instrument). The key movement (middle C, D, E, F), pallet movement (C, D) and pressure in the groove of middle C (measured by removing the Principal 8′ pipe) were measured, as well as sound recordings being made. All magnitudes are to an arbitrary scale.

Figure 13. Key and pallet movements, pressure in groove and sound recording of a note played using the Portato Rhetorical Figure

Figure 14. Key and pallet movements, pressure in groove and sound recording of a note played using the Transitus Rhetorical Figure

Figure 15. Graph to show groupings of the pressure rise immediately under the pipe foot of a theme played in a number of expressive styles as listed in Tables One to Three. Student CP on the Casparini copy in Christ Church, Rochester, NY

Figure 16. Graph showing the key movements of student CP playing in a style described as “Romantic pp.” Casparini copy in Christ Church, Rochester, NY

Figure 17. Graph showing the key movements of student CP playing in a style described as “Virtuosic Light ff.” Casparini copy in Christ Church, Rochester, NY

Figure 18. Graph to show groupings of the pressure rise immediately under the pipe foot of a theme played in a number of expressive styles as listed in Tables Four and Five. Student LG on the Casparini copy in Christ Church, Rochester, NY

Figure 13. Key and pallet movements, pressure in groove and sound recording of a note played using the Portato Rhetorical Figure

Figure 14. Key and pallet movements, pressure in groove and sound recording of a note played using the Transitus Rhetorical Figure

Measurements were made of Speerstra playing in these styles on the North German organ in the Örgryte Church in Göteborg (built in the style of Arp Schnitger by the Göteborg Organ Art Centre [GOArt] as a research instrument). The key movement (middle C, D, E, F), pallet movement (C, D) and pressure in the groove of middle C (measured by removing the Principal 8′ pipe) were measured, as well as sound recordings being made. All magnitudes are to an arbitrary scale.

Figure 15. Graph to show groupings of the pressure rise immediately under the pipe foot of a theme played in a number of expressive styles as listed in Tables One to Three. Student CP on the Casparini copy in Christ Church, Rochester, NY

Figure 16. Graph showing the key movements of student CP playing in a style described as “Romantic pp.” Casparini copy in Christ Church, Rochester, NY

Figure 17. Graph showing the key movements of student CP playing in a style described as “Virtuosic Light ff.” Casparini copy in Christ Church, Rochester, NY

Figure 18. Graph to show groupings of the pressure rise immediately under the pipe foot of a theme played in a number of expressive styles as listed in Tables Four and Five. Student LG on the Casparini copy in Christ Church, Rochester, NY

Measurements were made of Speerstra playing in these styles on the North German organ in the Örgryte Church in Göteborg (built in the style of Arp Schnitger by the Göteborg Organ Art Centre [GOArt] as a research instrument). The key movement (middle C, D, E, F), pallet movement (C, D) and pressure in the groove of middle C (measured by removing the Principal 8′ pipe) were measured, as well as sound recordings being made. All magnitudes are to an arbitrary scale.

Figure 15. Graph to show groupings of the pressure rise immediately under the pipe foot of a theme played in a number of expressive styles as listed in Tables One to Three. Student CP on the Casparini copy in Christ Church, Rochester, NY

Figure 16. Graph showing the key movements of student CP playing in a style described as “Romantic pp.” Casparini copy in Christ Church, Rochester, NY

Figure 17. Graph showing the key movements of student CP playing in a style described as “Virtuosic Light ff.” Casparini copy in Christ Church, Rochester, NY

Figure 18. Graph to show groupings of the pressure rise immediately under the pipe foot of a theme played in a number of expressive styles as listed in Tables Four and Five. Student LG on the Casparini copy in Christ Church, Rochester, NY

Measurements were made of Speerstra playing in these styles on the North German organ in the Örgryte Church in Göteborg (built in the style of Arp Schnitger by the Göteborg Organ Art Centre [GOArt] as a research instrument). The key movement (middle C, D, E, F), pallet movement (C, D) and pressure in the groove of middle C (measured by removing the Principal 8′ pipe) were measured, as well as sound recordings being made. All magnitudes are to an arbitrary scale.

Figure 15. Graph to show groupings of the pressure rise immediately under the pipe foot of a theme played in a number of expressive styles as listed in Tables One to Three. Student CP on the Casparini copy in Christ Church, Rochester, NY

Figure 16. Graph showing the key movements of student CP playing in a style described as “Romantic pp.” Casparini copy in Christ Church, Rochester, NY

Figure 17. Graph showing the key movements of student CP playing in a style described as “Virtuosic Light ff.” Casparini copy in Christ Church, Rochester, NY

Figure 18. Graph to show groupings of the pressure rise immediately under the pipe foot of a theme played in a number of expressive styles as listed in Tables Four and Five. Student LG on the Casparini copy in Christ Church, Rochester, NY

Measurements were made of Speerstra playing in these styles on the North German organ in the Örgryte Church in Göteborg (built in the style of Arp Schnitger by the Göteborg Organ Art Centre [GOArt] as a research instrument). The key movement (middle C, D, E, F), pallet movement (C, D) and pressure in the groove of middle C (measured by removing the Principal 8′ pipe) were measured, as well as sound recordings being made. All magnitudes are to an arbitrary scale.

Figure 15. Graph to show groupings of the pressure rise immediately under the pipe foot of a theme played in a number of expressive styles as listed in Tables One to Three. Student CP on the Casparini copy in Christ Church, Rochester, NY

Figure 16. Graph showing the key movements of student CP playing in a style described as “Romantic pp.” Casparini copy in Christ Church, Rochester, NY

Figure 17. Graph showing the key movements of student CP playing in a style described as “Virtuosic Light ff.” Casparini copy in Christ Church, Rochester, NY

Figure 18. Graph to show groupings of the pressure rise immediately under the pipe foot of a theme played in a number of expressive styles as listed in Tables Four and Five. Student LG on the Casparini copy in Christ Church, Rochester, NY

Measurements were made of Speerstra playing in these styles on the North German organ in the Örgryte Church in Göteborg (built in the style of Arp Schnitger by the Göteborg Organ Art Centre [GOArt] as a research instrument). The key movement (middle C, D, E, F), pallet movement (C, D) and pressure in the groove of middle C (measured by removing the Principal 8′ pipe) were measured, as well as sound recordings being made. All magnitudes are to an arbitrary scale.

Figure 15. Graph to show groupings of the pressure rise immediately under the pipe foot of a theme played in a number of expressive styles as listed in Tables One to Three. Student CP on the Casparini copy in Christ Church, Rochester, NY

Figure 16. Graph showing the key movements of student CP playing in a style described as “Romantic pp.” Casparini copy in Christ Church, Rochester, NY

Figure 17. Graph showing the key movements of student CP playing in a style described as “Virtuosic Light ff.” Casparini copy in Christ Church, Rochester, NY

Figure 18. Graph to show groupings of the pressure rise immediately under the pipe foot of a theme played in a number of expressive styles as listed in Tables Four and Five. Student LG on the Casparini copy in Christ Church, Rochester, NY

Measurements were made of Speerstra playing in these styles on the North German organ in the Örgryte Church in Göteborg (built in the style of Arp Schnitger by the Göteborg Organ Art Centre [GOArt] as a research instrument). The key movement (middle C, D, E, F), pallet movement (C, D) and pressure in the groove of middle C (measured by removing the Principal 8′ pipe) were measured, as well as sound recordings being made. All magnitudes are to an arbitrary scale.

Figure 15. Graph to show groupings of the pressure rise immediately under the pipe foot of a theme played in a number of expressive styles as listed in Tables One to Three. Student CP on the Casparini copy in Christ Church, Rochester, NY

Figure 16. Graph showing the key movements of student CP playing in a style described as “Romantic pp.” Casparini copy in Christ Church, Rochester, NY

Figure 17. Graph showing the key movements of student CP playing in a style described as “Virtuosic Light ff.” Casparini copy in Christ Church, Rochester, NY

Figure 18. Graph to show groupings of the pressure rise immediately under the pipe foot of a theme played in a number of expressive styles as listed in Tables Four and Five. Student LG on the Casparini copy in Christ Church, Rochester, NY
Excessive noise on key release may also mask the release transient.

An example from Group 1 shows a relatively gradual start of the key movement, the first in the sequence. The accent is on the second note of the sequence.

Figure 14 shows a comparable note from Group 2. The key initially accelerates quickly and shows a distinctly different form of movement from Figure 13. The accent is on this note.

The initial movement of the key is fundamentally different, and tests on the sm Cedar-into-steel stripe in the case of the portato playing style, the finger was in contact with the key at the start of the movement, whereas in the transitus example, the finger started its movement from above the key and thus was moving with significant speed when it contacted the key, causing a much greater acceleration of the key.

Measurements were also made on the copy of the Casparini organ of 1779 from Vilnius, Lithuania, built by CO Art in Christ Church, Rochester, New York, for the Eastman School of Music (ESM). A number of doctoral organ students played in styles of their choice that they considered resulted in variations of expression, including different transients. They used their own descriptions of these styles, some of these were long and descriptive and cannot be incorporated onto the graphs. The presure was measured directly under the pipe foot using a device made by the ESM organ technician Bob Kemper, and is not directly comparable with the previous examples. The groupings of pressure rise profile have again been superimposed to highlight the similarities, and the three scale does not represent a constant start point of the sample. Each group is of the same theme used in the previous exercise.

Figure 15 shows the measurements from Group 1. There is no clear identification of the two groups, which again suggests a very distinct difference between them.

The curves are in sequence of time of closing and are from left to right, using the numbers in Tables Four and Five. The accent is one of the two extremes, and the pallet does not start closing until after the key has started moving, indicating a degree of friction in the action.

Comparing Figure 20 with Figure 22, the weak note in Figure 20 has resulted in an extended pre-pluck movement of the key compared with the strong note in Figure 22. This is not reflected in the pallet movements to the same extent and, as discussed above, may result in timing differences in the sounding of the pipe if the player perceives the note as starting when the key starts to move.

All of the six student subjects demonstrated significant groupings of pressure along the lines of the examples shown above.

---

**A RUBENSTEIN FAMILY ORGAN RECITAL**

**EXTRAVAGANTLY TALENTED ... FANTASTICAL AND MEMORABLE.**

– The New York Times

---

**ALL SEATS $15!**

**GRAMMY AWARD NOMINEE**

**CAMERON CARMICHIE**

**WEDNESDAY, OCTOBER 16 AT 8 | CONCERT HALL**

Tickets on sale now! (222) 467-9600 kennedy-center.org

Tickets also available at the Office | GPU 222-467-9600 | ticketcenter@kennedy-center.org

**Presented and Alban Rubenstein on the Promenade Organs of the NWC.**
Key release

Throughout this project, players have stated that even if there may be reasons why the attack may be difficult to control, it is possible to control the release accurately. There seems little evidence that this is actually the case. While it is possible to control the initial movement of the key during the release stage because there are no similar effects to pluck, this does not necessarily allow for control of the ending transient. In the same way that the pressure in the pipe foot reaches its peak very early in the pallet opening it starts to reduce very late in the pallet closure. The corollary of pluck is that this is actually the case.

By editing the steady part of the slow movement out to make the notes the same length just leaving the transients, informal listening tests confirmed that there is no difference in the sound of the transients. The difference between the notes is that of the pipe being investigated. It can be seen that the pressure in the pallet box reduces as the pallet opens, oscillates for a few cycles, and then steadies. This is reflected in the pressure measured under the pipe foot and also in the sound envelope of the pipe speech. When the pallet closes there is a corresponding increase in pressure. The variations shown here are around 35% of the steady pressure. These measurements were made on the model organ in Edinburgh and while the effect will occur in any organ, the magnitude of these effects may be greater than normally encountered. A schwimmer system will reduce these effects.

The pipe of the first note, E, was removed so that its sound did not interfere with that of the pipe being investigated. It can be seen that the effect of the release of the first note and of the attack of the second, F, have resulted in an even greater variation in the pressure throughout the wind system, and this is reflected in the outline of the sound recording. Listening tests have not been carried out, but this may lead to an audible difference in the transient of the second pipe.

Many notes being played together will produce large and random pressure variations in the wind system. These effects are also apparent with electric actions.

It should also be noted that since pluck is directly related to the pressure in the pallet box, it will vary in proportion to it. It is thus possible that a momentary change in the magnitude of pluck could influence the time at which a key is depressed—especially if the player is already applying some force to the key.
Length of transient

In Figures 27 and 28, played on the ca. 1770 Italian organ in the Museum of Art, Rochester, New York, the pipe is slow to speak and starts at the octave and then breaks back to the fundamental.

If a short note is played, as when the player is asked to make a "fast" attack, some of the pipe speech will be at the octave and that is what the listener perceives as the pitch of the note. If a longer note is played, most of the pipe speech will be at the fundamental and that is what the listener will hear. If the player is expecting a variation in transient, he may associate the different perceived sounds with what he believes are different key movements. In Figure 27, there is also evidence of initial mechanical noise. Note again that the nature of the attack that has been reflected in the length of the note.

Conclusion

There is clear evidence that rhythm and timing are critical aspects of organ playing. In some cases they are the result of deliberate and systematic efforts by the player, as in the use of rhetorical figures, and in others the players may be unaware that they are making variations. Analysis of the various performances of the same sequence of notes showed wide variations in overall tempo, relative lengths of notes, and degree of overlap of notes, all of which will affect how it sounds to the listener. These and some other effects like variations in pressure in the wind system are independent of the type of action.

There is some evidence that transient control is difficult to achieve by the inherent design of the mechanical bar and slider windchest. Variations in key and thus, to some extent, pallet movement cause the pressure rise in the pipe foot to fall into distinct groups, the reason for which is still under investigation but would appear to be due to whether the finger starts in contact with the key or is already moving from above the key when it starts the note. Whether these differences result in audible changes is not clear and is likely to vary from organ to organ, and it is necessary to carry out properly controlled listening tests. Action noise may be a factor in informal listening tests. Action noise may be a factor in informal listening tests.

Notes

1. Alan Woolley, Mechanical Pipe Organ Actions and why Expression is Achieved With Rhythmic Variation Rather than Transient Control (Proceedings of EMSA, Sydney and Katoomba, 2010), paper number 2.

Figure 26. Effect of the variation on the pressure in the wind system due to the release of a note on a subsequent note

The organist can apply a certain force that it provides good tactile feedback. But there is clear empirical evidence that this may have been one key movement are predetermined. It is unlikely that the original builders of the first windchests applied theoretical fluid dynamics to the design, and other reasons for its endurance may include: 

- Ease of construction 
- Reliability 
- Ease of repair 
- Snapping of the pallet to give a good seal.

Every organ is different and this project has been limited by the instruments available. While this work may suggest that direct transient control is difficult, this may not be the case on instruments with different characteristics. There are, however, other mechanisms in play that may explain different perceptions of the sound. This project is continuing and, with the cooperation of our colleagues around the world, it is expected that a clearer understanding of these important issues will emerge.

Acknowledgements

My thanks to the Arts and Humanities Research Council, Professor Murray Campbell and Dr. John Kitchen at Edinburgh, the staff and students of GOArt and the Eastman School of Music, Joel Specerstra for his very helpful review of this article, Dr. Judith Angster and Professor Andras Miklos, Laurence Libin, John Bailey of Bishop and Sons in Ipswich, David Wyde of Henry Willis and Sons in Liverpool, and many others.

ATLANTA CHAPTER, AGO

ANNOUNCES

THE TAYLOR ORGAN COMPETITION

SATURDAY, APRIL 18, 2015

OPEN TO INDIVIDUALS BORN AFTER JUNE 1, 1992

1ST PRIZE $10,000 AND A SOLO RECITAL IN ATLANTA

2ND PRIZE $5,000

APPLICATION DEADLINE OCTOBER 15, 2014

For complete details including repertoire, please see www.taylororgancompetition.com

www.agoatlanta.org

12. Alan Woolley, "Transient variation in mechanical and electric action pipe organs" (Proceedings of Meetings on Acoustics, Acoustical Society of America, Montreal June 2013, Volume 191), Paper no LAME3. Alan Woolley obtained a degree in applied physics from the Lanchester Polytechnic in 1976. In 1998 he decided that the organ was more interesting than his current job and was awarded an MA in Organ Historiography from the University of Reading in 2000. This led to researching for a PhD in Music at the University of Edinburgh looking at how organists actually used the key. This was awarded in 2006. This work in turn resulted in a further project being funded by the Arts and Humanities Research Council to look primarily at the use of rhythm and timing in a means of expressive playing. This was based in the Musical Acoustics Group of the School of Physics at Edinburgh working with Prof. Murray Campbell and Dr. John Kitchen. He is currently an Honorary Fellow at Edinburgh where the work with Prof. Campbell on actions and airflow in the windchest is continuing.

All illustrations by Alan Woolley