

Audiovisual Gesture and Spectromorphology: the *Invalid Data W.E.S.T.* project

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Abstract

Within the contexts of music and musical performance, ‘gesture’ might be used to refer to the physical gestures musicians make in performance, or to the shape of musical phrases or sonic phenomena. Denis Smalley’s influential concept of ‘spectromorphology’ takes up this question of the shapes of sounds, and applies it to the domain of electroacoustic music. And more recently, theorists and artists in visual music have begun to explore the myriad ways visual and aural spectra can relate. In this paper, we detail a project that seeks to expand the ways in which the concepts of gesture and spectromorphology can be understood and applied in audiovisual projects. The *Invalid Data W.E.S.T.* project proposes that understanding spectromorphology in visual domains requires consideration of the wavelengths of light that give us an image. In this project, the complex interaction between clouds and solar radiation becomes the medium for understanding this concept of visual spectra.

Invalid Data W.E.S.T. is a collaboration between media artist Grayson Cooke, audio engineer Ian Stevenson, and the experimental improvising group Wilcox, Encarnacao, Swanton Trio (W.E.S.T.), comprising three Australian composer-performers: Felicity Wilcox (piano), John Encarnacao (guitar), and Lloyd Swanton (bass). In this project, a multi-camera recording of W.E.S.T. in studio performance is combined with Cooke’s exploration of creative uses of satellite data. Satellite images of clouds rendered using infrared light are intercut with in-depth, multi-camera footage of W.E.S.T. captured during improvisation. The resulting audiovisual meditation draws parallels between spontaneous artistic processes, collaborative creation, and environmental phenomena. In this paper, we explore how concepts of gesture and spectromorphology shaped the conception, production and post-production phases of the project, and in turn how these concepts can be used to enhance the production of audiovisual work.

Keywords

Gesture, audiovisual, visual music, spectromorphology, improvisation, clouds, satellites

Audiovisual Gesture and Spectromorphology: the *Invalid Data W.E.S.T.* project

Introduction

Gesture is a complex concept when understood in the context of music; however, of key significance is its metaphorical relation to the shape of musical and sonic articulations. Denis Smalley's concept of 'spectromorphology' (1997) takes up this question of the shapes of sounds, and applies it to the domain of electroacoustic music. More recently, theorists of visual music have used these concepts to explore the myriad ways visual and aural gestures and spectra can relate. In this paper, we detail a project that seeks to expand the ways in which the concepts of gesture and spectromorphology can be understood and applied in audiovisual projects. The *Invalid Data W.E.S.T.* project proposes that understanding spectromorphology in visual domains requires thinking about the electromagnetic spectrum and the wavelengths of light that give us an image; that is, if spectromorphology in sonic domains involves a focus on morphologies of sonic frequency and wavelength, then in visual domains it must focus on light – its components and behaviours. In this project, the complex interaction between clouds and solar radiation, the use of infrared light to highlight this complexity, and the editing of images of clouds into a work of visual music, becomes the process for understanding this concept of visual spectra.

Invalid Data W.E.S.T. is a collaboration between media artist Grayson Cooke, audio engineer Ian Stevenson, and the experimental improvising group Wilcox, Encarnacao, Swanton Trio (W.E.S.T.), whose practice in freely improvised performance was established prior to the project. W.E.S.T. comprises three Australian composer-performers: Felicity Wilcox (piano), John Encarnacao (guitar), and Lloyd Swanton (bass). A defining aspect of W.E.S.T.'s approach is that the band improvises using their instruments in unconventional ways wherein objects are interfaces for performance, activating the entire instrumental apparatus and providing a mechanism for what we will refer to here as expanded techniques, due to the ways they build on more conventional extended techniques. These experimental techniques and the resulting sounds form the basis of W.E.S.T.'s musically and visually intriguing performances, and it is this gestural intrigue and sonic complexity that *Invalid Data: W.E.S.T.* (hereafter IDWEST) builds upon.¹

In this project, a multi-camera recording of W.E.S.T. in studio performance is combined with Cooke's ongoing exploration of creative uses of satellite data, produced through a long-term collaboration with Geoscience Australia and the Digital Earth Australia (DEA) satellite-imaging program. One of the outcomes of this collaboration has been a project called 'Invalid Data' where Cooke works creatively with the algorithms used by DEA to filter clouds from the data.² Because DEA use satellite data to monitor environmental change, they must use complex algorithms to filter clouds from the data and obtain clear pictures of the land. Cooke's process inverts these algorithms and focuses on the data deemed invalid in geoscientific contexts, which in fact represents a multi-year database of the cloud layer across the Australian continent. IDWEST uses data from the Landsat 8 satellite, an earth observation satellite that records data in 10 separate bands from visible through to thermal infrared (USGS n.d.). In IDWEST, satellite images of clouds rendered as surreal multi-coloured forms by using infrared light, are intercut with in-depth, multi-camera footage of W.E.S.T. captured during improvisation, translating the visual languages of live event coverage and music video into a long-form visual music work. The resulting audiovisual meditation draws parallels between spontaneous artistic processes, collaborative creation, and environmental phenomena.

¹ A trailer for IDWEST can be viewed here: <https://vimeo.com/346649054>. The full version can be viewed here: <https://vimeo.com/421809072>.

² See <https://www.graysoncooke.com/invalid-data>.

Background

Invalid Data W.E.S.T. is a work of visual music, where ‘music is made visible,’ through - in the words of Friedemann Dähn - ‘an equal and meaningful synthesis of the visible and audible’ to create its own artform (Dähn 2009: 149). The initial output of the project was a 37-minute single-channel film; this fixed media work was followed by a live audiovisual improvisation involving all five artists, using multi-channel video and sound. Both versions premiered at Create NSW’s ‘Play the City’ event in Sydney in February 2021.³ It is the fixed media work that this paper considers.

Conceptually, the work was intended to do two things: firstly, to produce an in-depth audiovisual exploration of the complex gestural actions of three seasoned musicians in improvised performance. Secondly, to juxtapose the performance footage with satellite images of clouds, introducing an environmental resonance in response to the music, expanding the audiovisual potential of the project and adding the consideration of visual spectra to the concept of spectromorphology. Visual spectromorphologies of electromagnetic energy are set against and edited to spectromorphologies of sound frequency, bringing a new material and environmental resonance to the colour-sound associations proposed by Isaac Newton and many others since, which have formed the basis of much theory and practice in visual music (van Campen 1999: 9).

The video was filmed in the multi-cam TV studio at Southern Cross University in June 2019; six cameras, directed by Cooke, were used to capture the performance, in order that a wide range of views, close and wide, still and moving, could be used both to record the performance and provide variety in the editing stage. The sole preparatory discussion between Cooke, as visual director and editor, and the performers in *W.E.S.T.* was that they consider clouds, both in the abstract and literal sense, as a seed for their improvised performance. In this regard, in implementing their creative process, the team were drawing on what Manuella Blackburn calls a ‘spectromorphological vocabulary’ (2009) – an approach that positions ‘vocabulary as the informer upon sound material choice and creation.’ Building upon spectromorphology’s prior applications as a descriptive tool for electroacoustic music analysis and aural perception, visual representation, and notational function (e.g. Smalley 1997; Thorensen 2007; Patton 2007), Blackburn notes that for composers, ‘words more readily visualized ... and those with a clear associated physicality ... appear better suited for informing sound material creation’ (Blackburn 2009).

As noted, *W.E.S.T.* are free improvisers who produce novel sonic results with their instruments, so providing a space in which to explore this core component of their practice as something of both visual as well as aural interest was a prime motivator for this project. One of *W.E.S.T.*’s defining performative methodologies is the free-flowing alternation between, and even simultaneous execution of, both standard instrumental techniques and expanded techniques involving everyday objects as interfaces for exploring timbres for piano, double bass and semi-acoustic guitar beyond those achieved via more common extended techniques. Such expanded techniques also encompass the exploration of the entire structures of these instruments (e.g. the piano’s strings, external casing and frame, the body and the pegs of the double bass, and the guitar body and underside of the strings).

Gesture, then, with its performed expressions, both musical and visual, lies at the core of this project. Through conducting a very close visual examination of the performative gestures of the musicians and recording the sonic result, the project suggests there is much to be gained from using

³ This event was held at Pitt St Uniting Church, Sydney on 27 February 2021, funded by Create NSW, with additional funding provided by University of Technology Sydney, School of Communications. Another screening of the fixed work took place at World Square, Sydney, during *Music for Your Eyes*, part of the ‘Now You Hear Her’ Festival on 25 March 2021.

the attentional capacities of the camera to explore improvised performance, and expands thinking about possible spectromorphologies into audiovisual domains.

Gesture

The concept of gesture has multiple expressions when understood in the context of music and musical performance. It can refer both literally to the physical gestures musicians make in performing, and metaphorically to the shape of musical phrases or sonic phenomena (Carvalho 2017: 1). Further, gesture, as it pertains to performance, can also be broken down into a distinction between the ‘operational gestures’ and actions physically required to produce a given sound, and the ‘expressive performing gestures’ musicians make, either as physical expressions of emotive states during performance, or as communicative signals to other members of the group (ibid. 4).

Compositionally, gesture is understood as the creation of sound material that assumes a physical trajectory, or that is ‘vectorised’ in time and space (Chion 2019: 17-18). Gesture eschews standard musicological descriptors; what are referred to as musical gestures are understood by composers and performers to be about sound organisation that sits outside standard classification according to the ‘primary’ domains of pitch, harmony and rhythm (although they might comprise aspects of these), and find their place more often among the less quantifiable ‘secondary’ musical domains of timbre and texture (Moore 2001). For this reason, gesture features strongly as a concept in spectromorphological thinking (Watkins 2018, 63), where it is ‘an energy-motion trajectory which excites the sounding body, creating spectromorphological life. From the viewpoint of both agent and watching listener, the musical gesture-process is tactile and visual as well as aural’ (Smalley 1997: 111).

Gesture is also at the core of the set of pleasures involved in attending live musical performance. Romantic notions of the magic of live performance and the special energy that arises between performer and audience have been criticized for obscuring the degree to which concepts of liveness are frequently reliant on some form of mediatisation (Auslander 1999: 2, 58); the same critical logic lies behind critiques of documentary indexicality, whereby a cultural fantasy of *cinéma vérité* obscures the myriad aesthetic and political decisions that lie behind the documentary image. Nevertheless, without recourse to such abstractions, there is no question that witnessing live musical performance is satisfying for a number of reasons arising from the performance context. We argue that a large part of this has to do with gesture, and specifically with the pleasure of audiovisually witnessing the making of sound. Even in electroacoustic music, Smalley argues, ‘when we hear spectromorphologies we detect the humanity behind them by deducing gestural activity’ (1997: 111).

i. Listening and Causality

Studies of causality in audiovisual perception hinge on the spatiotemporal correspondence of sound and image. ‘If a visible action seems to precede an appropriate sound, humans integrate the two streams of information and perceive the action as having caused the sound’ (Emerson & Egermann 2018: 97). Further, studies of congruency suggest that perceptions of causal synchrony in audio and visual stimuli are intrinsically pleasurable – a notion reinforced by the widespread acknowledgement, especially in studies of sound in film, of the displeasure of perceiving a lack of synchrony in causally-related sounds and images that would normally occur simultaneously, such as vocal utterances (ibid. 98).

Beyond the basic fact and pleasure of experiencing causal audiovisual synchrony, visually perceiving the production of sound is also understood to involve other inferences, which can

heighten audience pleasure. Visual perception of musical performance can contribute to assessments of skill and virtuosity in performance, an effect that is heightened by elements of novelty and variety in operational gesture (Emerson & Egermann 2018: 106; Broughton & Stevens 2009: 149). Expressive gestures, which Vines et al. relate to ‘paralinguistic’ gestures such as facial expressions or changes in bodily comportment, are understood to heighten the experience of musical performance as they add interpretive nuance to the act of audiation, giving insight into the performer’s affective and cognitive states (Vines et al. 2006: 107).

These effects are particularly pertinent in projects such as IDWEST which show improvised performance where an experimental virtuosity in performance results in images of novel actions coupled with original and unexpected sounds. At various times through IDWEST we see the piano knocked and scraped with percussion mallets, brushes or a credit card; the bass slapped or stroked, and a plastic bag applied to its neck during pizzicato passages; and the guitar twanged with chopsticks or dabbled with RCA cables (Figure 1). W.E.S.T.’s expanded techniques are visually novel, not always obviously aligned to the unusual sounds they produce, and such novelty is heightened by their spontaneous emergence in improvised performance rather than at the direction of a musical score.

W.E.S.T.’s practice is unusual for instrumental performance in that, via these expanded techniques, they explore ‘gestural surrogacy’ (Smalley 1997: 112) – or the increasing remoteness of sound gesture to its source, causality most often seen in electronic music analysis. W.E.S.T. use both ‘second-order’ surrogacy, where ‘recognisable performance skill has been used to develop an extensive registral articulatory play;’ and ‘third-order’ surrogacy, where ‘we may not be sure about how the sound was made to behave as it does, what the sounding material might be, or perhaps about the energy-motion trajectory involved’ (ibid.). The result for the audience is akin to enforced causal listening, in Chion’s terms, an extended meditation on the interaction between a sound and its source (1994: 25). The close detail of physical actions and their sonic results also incites a proprioceptive, psycho-physical or neurobiological response in the audience, which Vines et al further relate to the widely theorised mirror neuron system in the brain (Vines et al. 2006: 105; Smalley 1997: 111; Pedersen et al. 2020: 101). As such, resolving or otherwise ignoring the recurring tensions that emerge between what one is hearing and what one is seeing during a W.E.S.T. performance, and having the camera replicate this process, became a key focus of the visual director’s choices for the IDWEST project.



Figure 1: Video still at 03’40” of all 6 cameras. All cameras in CU, MCU or MS focused on expanded techniques and their gestures.

ii. Viewing and Heightened Attention

Such explorations of listening and causality point not only to the value for audiences of attending live musical performances, but to the contribution made by projects that use the heightened attentional capacities of the camera to give audiences a privileged experience of these rich audiovisual performance elements. Various sequences in the work are given over to a visual exploration of the performers' emotional or communicative states as expressed in gestural and postural signals. The cameras provide a precise and detailed study of W.E.S.T. in performance in Close Up (CU) or Medium Close Up (MCU) shots, holding position for extended periods. As noted above, six cameras were used to record the performance in order to provide a wide variety of shots. Three of these cameras had long lenses fitted in order that they could capture in close detail the intricacies of each musician's performance – in far greater detail than the audience at a live performance would normally see. This technical capacity is core to the concept of the work – the cameras do not document the performance as if watching from the outside, neither are they simply recording devices. Rather, the visual director directs and orchestrates their focus in response to listening to the performance and watching it unfold, thus creating and determining the viewable domain of the performance.

In one sequence, all three fixed cameras were instructed to slowly move to CU on their respective performer. This is a technique influenced by Mike Figgis' *Timecode* (2000), a one-take feature film shot simultaneously with four cameras and presented with an image in each quarter of the screen.⁴ This technique was explored to provide a cross-section of performer facial expression across the group, and fittingly, one of the most common postures/expressions evident in the work is that of listening. While at times each performer can be seen engaging in visual communication with other members, most commonly they are seen listening, head bowed, eyes closed, often very still. Such moments create a striking counterpoint to those 'textured impulses' and 'pocket[s] of added intensity' (Smalley 1997: 120) involving noise generated by expanded techniques, and they give insight into the ebb and flow of ideas, the 'flux' of forces that shape the dynamic of improvised performance (Pedersen et al. 2020: 101).

An extended period focusing on this phenomenon emerges around halfway through the work, as the group enters into a slow, musically consonant passage that Cooke subsequently interpreted to be a particularly cloud-influenced and reverent sequence through his editing. Wilcox leads this section, teasing out a motivic cell in the key of F# minor using conventional playing on the keyboard. The effect is calming, settling the music after a long period of frenetic gestural and expanded-technique exploration in which all performers are very active. Wilcox develops her melody gradually until it lands in a crystallised statement, and Swanton's alternating, sustained high and low register arco harmonisations further evolve and colour it. This mostly diatonic passage is all the fresher after the extensive noise-scape explored earlier in the set, and contributes to the soothing effect it exerts on the listener: an example of 'musical resolution or repose, or the satisfying fulfilment of expectations that occurs when consonance follows dissonance' (Alves 2012: 116). At the same time, a striking 'visual consonance' (ibid: 114) emerges in synchronisation with this point of stability and resolution in the music. All cameras were directed to move to Encarnacao on guitar, and to settle on different shot-lengths and angles (Figure 2). Immediately what emerges is a rich study of a single performer in real time. Paradoxically, as mentioned, the bulk of the dynamic musical content is carried by the piano and the bass; the guitar is primarily producing long resonant and consonant tones that are only consciously heard on the occasions when Encarnacao seeks a new chord. Mostly what is witnessed in this extended study is the guitarist engaged in a very intense period of listening and focus. His gestures are minimal and marked by their absence, hence what this sequence represents is a necessary antithesis to the much more pronounced and self-evidently causal audiovisual gestures experienced elsewhere in the work.

⁴ Various mechanisms are employed throughout Figgis' film to unite the separate camera streams in a kind of montage of simultaneity, one of which is that all four cameras drift into CU at various points.



Figure 2: All cameras except for one watching John listening.

Here, through a heightened visual attention on the listening posture, the work draws focus to its sonic qualities and leaves aside causality as the primary audiovisual relation structuring the work. Instead, it calls upon the audience to interrogate the practice of causal listening, to shift their orientation towards what Chion, building on Schaeffer, terms ‘reduced listening,’ where sound itself is ‘the object to be observed’ (Chion 2019; 25). This in turn reflects an acousmatic approach where the source of the sound is absent (Chion 1994: 29; Smalley 1997: 109). Regarding this shift in focus in IDWEST, Smalley’s own words regarding reduced listening seem apt: ‘We seem to cross a blurred border between events on a human scale and events on a more worldly, environmental scale’ (1997: 113), and Cooke’s decision to intercut shots of Encarnacao’s surrendered posture with an extended study of rich cloud textures communicates an affective state about the environment that is embodied through the guitarist’s reverence, stillness and relative silence.

Spectromorphology

Having explored gesture as a question of physical action or bodily comportment, we would now like to turn to its sonic corollary, the sounds produced by physical gestures or performer actions and their aural qualities: their spectromorphology. Smalley’s concept of spectromorphology was introduced in the context of the reception and production of electroacoustic music in order to focus analytical attention on ‘the interaction between sound spectra (*spectro-*) and the ways they change and are shaped through time (*-morphology*)’ (Smalley 1997: 107). Smalley argues that spectromorphological thinking requires eschewing a focus on the source of a given sound, or its relation to musical notation or harmonic analysis, in favour of a focus on its spectral qualities (ibid. 108-109).

Relating this concept to a visual music work that features concurrent visual and aural recording of live improvised musical performance, and sequences where this musical performance is edited together with images of clouds rendered with infrared light, is necessarily a divergence from the concept’s initial formulation. Smalley notes that many of the sonic morphologies that he describes are physical processes that occur in many domains, and are not exclusively reserved for musical contexts (Smalley 1997: 110). Moreover, the vocabulary Smalley develops for spectromorphological thinking is intrinsically spatial and visual; not merely does he frame the entire enquiry as a question of sound ‘shapes,’ but his typology of spectromorphological processes all have strong visual connotations: ascent, descent, oscillation, undulation, rotation, agglomeration, dilation etc. (Smalley 1997: 116). He talks of sound drifting, floating and flying, and of sonic textures that exhibit flocking, convolution or turbulent behaviour (ibid. 117-118). In acknowledging

that at bottom he is describing processes of motion, growth and the transfer or flux of energy, Smalley presupposes the opening of spectromorphological thinking to a much wider range of contexts.

Owing to the visual language inherent in any discussion of sound shapes, as well as the convention of rendering sound frequency and duration visually on a spectrograph, spectromorphology is a concept that has readily migrated across into the production and analysis of visual music, typically in works that utilise essentially abstract imagery (Garro 2012: 103; Pedersen et al. 2020: 102). As Pedersen et al note and explore in their own work, the movements and behaviours described by Smalley can be easily applied to human movement and to the morphologies of the moving image (Pedersen et al. 2020: 102). Thus, we can imagine a visual music work that might seek to accompany sounds that seem to float or undulate with images that exhibit similar qualities in their motion and textural evolution.

This is the essence of ‘visual listening’ – translating sonic qualities into visual expression through seeking to reflect or provide counterpoint to one mode in the other – and in visual music scholarship it gives rise to considerable discourse regarding the potentials for tight or loose audiovisual relations, and the metaphoric or parametrically-mapped binding of image and sound (Garro 2012: 106; Watkins 2018: 55; Pedersen et al. 2020: 104). In IDWEST, visual listening was implemented firstly during production in the TV studio when the visual director directed camera view and movement to both record and reflect the expressive gestures and sonic events of the performance. Secondly, visual listening was employed during the editing phase, both in choosing shots of the performers that best highlighted their expressive gestures, and in working creatively with satellite images of clouds. The clouds are layered on top of the performance footage, sometimes composited into the footage so they appear to merge and drift amongst the performers (Figure 3), and sometimes laid on top to obscure the performers and develop a new audiovisual language premised on finding connections or creating audiovisual counterpoint between the spectromorphologies in the music, and the forms, colours, textures, animated movements and rhythmic sequencing of clouds.



Figure 3: IDWEST still image excerpt; compositing of cumulus clouds in convection cells over John Encarnacao.

Thus IDWEST shuttles between a causal audiovisual relation where the source of the sound is more or less evident, and an acousmatic situation where the audience hears music and sees clouds, and seeks loose or tight cross-modal connections between sound and image. In the sequences of the work featuring clouds, a wide range of rhythmic, textural and poetic audiovisual relations are explored. When the clouds are first introduced into the work, they are edited in a rhythm that synchronises with the rhythm in the music (Figure 4), establishing an audiovisual motif that recurs towards the end of the work as well (Audissino 2020). A rapid flickering of sequential images mimics irregular musical microrhythms: ascending piano flourishes alternating with high-frequency staccato noise created by Wilcox scraping her credit card across the upper piano strings; fast pizzicato notes on Swanton's double bass, the sound disrupted by a plastic bag inserted between the strings to introduce high-frequency noise content; and percussive reverberations executed via chopsticks wedged between Encarnacao's guitar neck and strings.

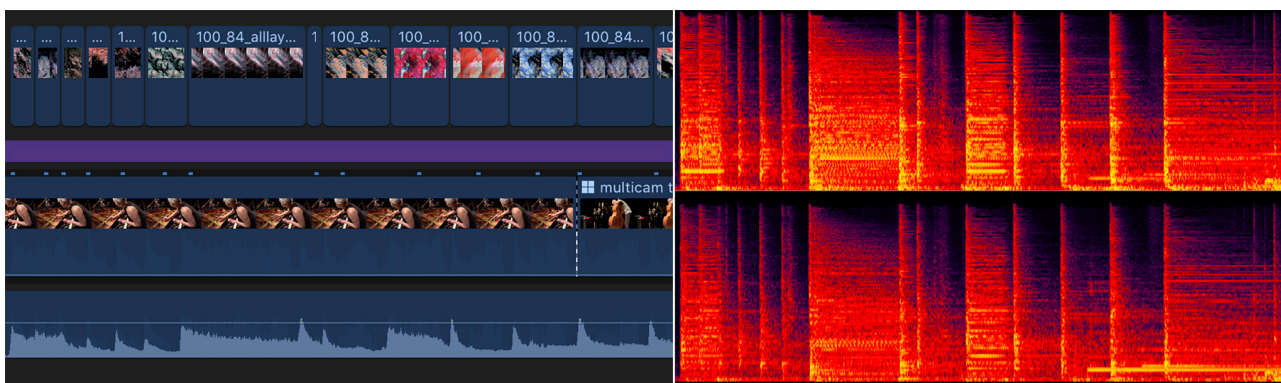


Figure 4: imitation between staccato image and sound

This tight audiovisual synchronisation between image and sound - between abstract sonic timbres and musical rhythms, and abstract cloud images rhythmically edited - sets the ground for the many permutations of image-sound relations that are developed through the editing process. Synchronisation both provides the pleasures of audiovisual congruency, as outlined above, and poses the question of causality, allowing that the audience might perceive that the musicians are 'playing' the clouds or vice versa. Further, this audiovisual pairing of high-pitched sonic content with brightly-coloured clouds is analogous, linking both to the physics of acoustic and visual spectra and to Smalley's concept of spectral space: 'higher pitches can be thought of as spatially higher' (Smalley 1997: 122). The perception of high frequency sounds as being high in space - that is, at the level of the clouds - is key to the way these sound/image associations work: 'High degrees of spectral mobility are concerned with higher registers (analogy with flight?)' (ibid.). As the dialogue between W.E.S.T.'s expressive noise outbursts and Cooke's rhythmically-cut cloud images develops, their combined gestural motion frames the work's texture and the overall effect across the entire audiovisual structure is that of a pulsing, 'textured interior' (ibid. 114).

Elsewhere in the work, clouds frequently appear in the spectral spaces framed by high-frequency noise and low-frequency drones. Smalley's discussion of space and density applies here: 'textures can be hung from canopies ... while ... the drone can act as a root-reference' (1997: 121). The absence of middle-frequency sonic spectra and the more sustained durations of the musical events in these sections allow for more sustained images of clouds to opaquely occupy the visual foreground. Here the work again provides for more focused contemplation of its detail, once again activating an investigative process in the audience. 'Detailed spectromorphological attributes and relationships are uncovered' (ibid. 111) via slow camera zooms and rotations, and a pared-back, slowly-fluctuating music that allow an enormous variety of cloud forms, granular noises and microtonalities to emerge. Microtonal pitch clusters begin to resonate with dense textures of clouds (Figure 5), picked out and differentiated through the infrared mapping and rendering; this combined

audiovisual complexity acts as a structural point that then resolves in the more conventionally diatonic, reflective section discussed above.

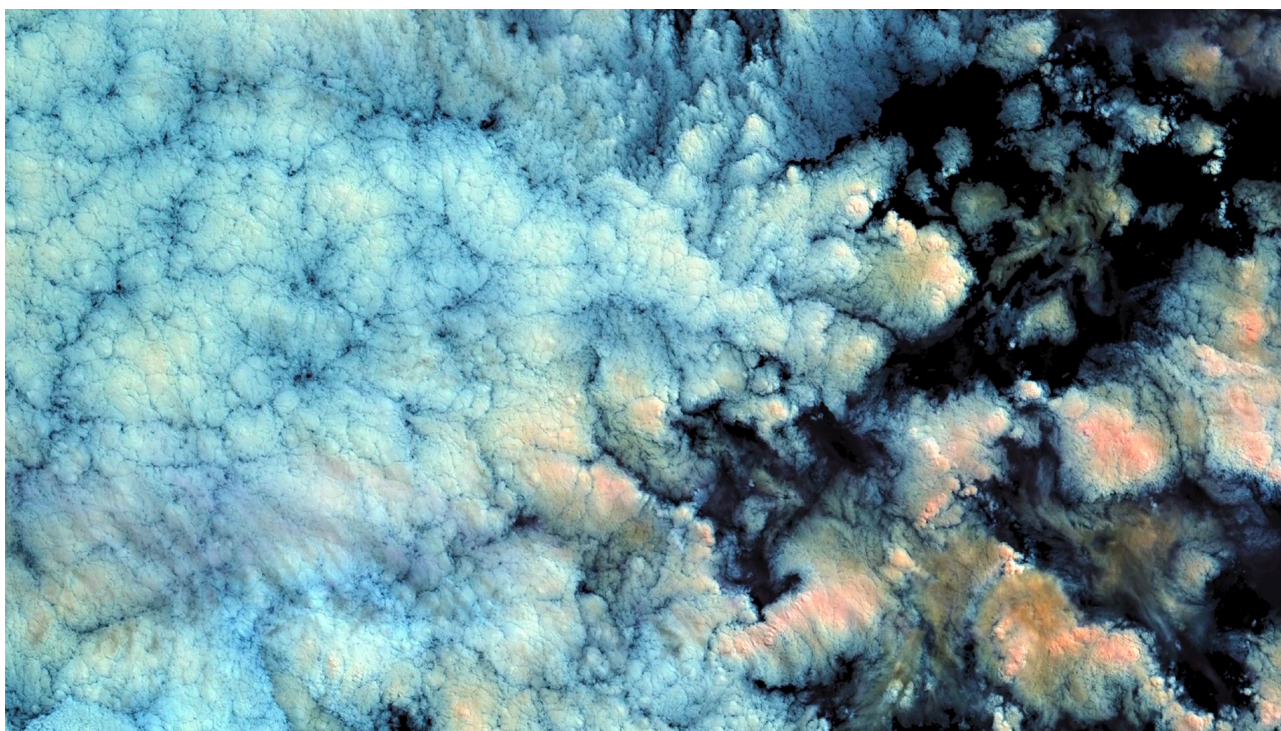


Figure 5: foregrounding of complex cloud textures

But there is a more material sense in which the decision to juxtapose images of clouds against a range of abstract sonic features is motivated. Earlier in this paper, we used the term ‘flux’ to describe both the interplay of forces between contributing artists, and the energy transfer required to produce a sonic event. From the Latin *fluere*, to flow, it is a term that has come to describe the transfer of energy through a surface or substance. Thus when used in relation to musical performance, we understand it to describe the spectromorphology resulting from rubbing, striking, plucking, or otherwise stimulating a sounding body - the transfer of energy from player gesture to resonant chamber and the production of sonic energy that results. In a more metaphorical sense, flux describes the transfer that occurs when subtle communication between performers in improvisation results in an exchange of sonic gesture, the evolution of musical motif, a change in timbre, or a growth in texture - a kind of transduction of affect and cognition into musical material, most powerfully culminating in the concept of *duende*, a sense felt by performers of playing without effort, and of being at one with each other and the sound. Smalley’s notion of ‘causality, where one event seems to cause the onset of a successor, or alter a concurrent event in some way’ (1997: 118), also describes the process of flux - a facet common to both acousmatic and improvised music.

Thinking about how flux might apply visually in this work opens up broader domains. The notion of flux as communication and transduction of affect would extend to the intuitive visual choices made in filming and then editing the work in response to the live and then recorded music track, with regard to camera movement, frame composition, shot sequencing, overlays, colouring, and rhythm. This project’s pairing of improvised music with satellite images of clouds, however, suggests we must also use it to refer to the flux of radiant solar energy performed by the Earth’s cloud layer, and by water vapour in the atmosphere. The infinite formal variety of clouds, and their behaviour in the atmosphere, are likewise a function of energy fluxes, hence their pairing, in this work, with W.E.S.T’s improvised sonic experimentation.

Because they reflect, absorb and emit radiation at a range of wavelengths, clouds are vital to all life on Earth, and it is their spectral properties that contribute a large part of this vitality. It is the variation in cloud height, temperature, thickness, and water and ice content that determines the spectral qualities and behaviours of clouds, but this complexity is rarely evident when only the visible part of the electromagnetic spectrum is used to observe them.⁵ Normally, we see clouds as white to grey bodies, a function of their reflection of visible light. When clouds are rendered using infrared light, as they are in this project, a much fuller spectral complexity is revealed, and so through this approach it is possible to gain a fuller apprehension of the complex energy fluxes they take part in.

As noted earlier, IDWEST uses data from the Landsat 8 satellite, which records reflected visible light as well as a range of infrared wavelengths. Rather than using visible light though, IDWEST renders clouds by mapping data from the near infrared (Band 5: 0.85-0.88 μ m) and shortwave infrared bands (Band 6: 1.57-1.65 μ m and Band 7: 2.11-2.29 μ m) to the red, green and blue channels of the output image, in that order (see USGS n.d.). The visual result is a surreal colour space where red, orange, yellow and pink clouds float over and interact with a turquoise land. Rendering clouds in this way forces the audience to look at them anew, they are de- and re-contextualised - they become something more than the white and grey bodies that drift above our heads. The colours introduced by the infrared mapping, and the textures that are highlighted more fully as a result of this mapping resonate more powerfully than plain white clouds against the sonic textures in the music. While the colours are not causally related to the musical morphologies, they focus audience attention on the clouds and force a consideration of their spectral complexity. This work's emphasis on highlighting the unseen-yet-essential spectral complexity of clouds enters into both a material and metaphorical resonance with the aural aspects of the work as explored in our discussion of spectromorphology and, at the same time, instigates an audiovisual dialogue with broader scientific themes regarding planetary health.

Conclusion

Gesture and spectromorphology are analytical and structural concepts by which artists and scholars have gained considerable insight into sonic phenomena, and, because of the intrinsically visual mode of description Smalley applies for sound shapes, these concepts have in turn become useful for producers and analysts of visual music. Visual phenomena, especially those produced in artistic contexts that exhibit some degree of abstraction, frequently exhibit many of Smalley's motion-based behaviours attributed to sounds. But the comparison remains metaphorical and only half explored if visual spectra are only understood as visually perceivable shapes, forms and behaviours. There is far more to be gained when visual spectra are understood within the context of the electromagnetic spectrum, and when non-visible wavelengths are given visual form, as in this project's use of multi-spectral satellite data.

What this project enables, then, is an application for the concept of spectromorphology to audiovisual works that is both metaphorical and material. The project allows for a range of causal and poetic relations to be drawn between the physical gestures of musicians, the novel musical gestures that result, and the enormous formal variety and richness of clouds. A spectromorphological framing of the work as a whole – with regard to concept, gesture, and vocabulary – aligns with IDWEST's overall focus on 'spectral energies and shapes in space, their behaviour, their motion and growth processes, and their relative functions' (Smalley 1997: 125) in this long-form audiovisual meditation on improvised music and clouds.

⁵ This is one reason why satellite sensors are multi-spectral; they record electromagnetic radiation in a range of specific bands across visible, shortwave, and longwave infrared wavelengths because this allows geoscientists and meteorologists to see environmental and atmospheric phenomena invisible to the human eye.

Beyond its function as a work of art, what IDWEST represents is a working method for expanding the concept of spectromorphology into audiovisual domains. Firstly it proposes that the concept of gesture in sound and in musical performance can be audiovisually enlivened through the attentional capacities of the camera, which allows for new knowledge and apprehensions to be gained through the close study of improvised performance. Secondly it proposes that visual music practitioners need not be limited to abstract shapes and forms in order to provide rich visual corollaries for sonic phenomena, but that this expansion requires thinking of visual elements as the combination of different wavelengths of light and not simply as visual forms. Doing so adds a rich environmental and material resonance and significance to audiovisual work.

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