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Bringing to light the voice figures of Margaret Watts-Hughes

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Abstract

In 1885, the Welsh singer and philanthropist Margaret Watts-Hughes embarked upon an extraordinary series of experiments on the shaping of materials and images with sound. In attempting to measure the loudness of her voice Watts-Hughes conceived and commissioned the making of an instrument she called the eidophone. Consisting of a mouthpiece and receiving chamber, across which was stretched a vibrating India rubber membrane, she discovered that the apparatus produced patterns in a variety of powders and fluids by way of its resonant articulation of sung notes – phenomena she named voice figures. A desire to 'fix' these patterns directly led her to applying the eidophone to pigments on glass.

This article will evaluate a recently unearthed archive of these works – never before seen in colour and previously thought lost – by examining details of the images in conjunction with Watts-Hughes' writing in order to gain insights into her practice. It will attempt to situate Watts-Hughes as an interdisciplinary practitioner, working within and around the contemporaneous discourses on early sound recording, science and the supernatural. Noting concordances with spiritualist practices and (given their relationship to radical social movements) implications for notions of female voice and power, an implied metaphysics of the voice is discussed, along with the possibility, or otherwise, to disinter the sound from these singular works of art. In an era where digital tools and practices enable the extraction of an audio signal from almost any form of visually represented sound, this article concludes with how we might contend with the voice figures – works of immense complexity which problematise this tendency towards direct sonification.

We think we know what sound would look like as a material, if only we had eyes to see it. An online image search for 'sound wave' offers up seemingly endless variations on the same theme, with a majority carefully rendered to look legitimate by way of a technologically constituted aura. Usually primary-coloured and luminous upon a neutral ground, these visions seem intent on persuading us that they have been caused rather than created – as though the specifically even gradations of tone and hue within striations, undulations and dancing lines, unencumbered by any 'gesture' of a hand, somehow designate these images as self-written.

That sound self-inscribes is intrinsic to its story of origin as a 'captured' phenomenon, and the ideal erasure of the recording apparatus – that the sound that is written should bear no marks attributable to the machine itself – comprises an ideological mainstay of phonography, one which has allegedly achieved its goals in digital practices. Finely and indivisibly heterogeneous, natural sound can be copied, but never repeated, lending recordings a seductive aura of event-hood and presence that often lies uncontested in writing on the subject.

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This imagistic tendency is not new; recorded sound began as much a visual and textual concern as an auditory one. Scott de Martinville developed his phonautograph in 1857 (to use a well-known example) in order to perform what he intended as a refined auto-stenography, capturing the nuances and inflections of an individual's speech to instantiate a more 'true' written form which might be read in the same manner as text [...] with enough practice. The device's mechanism of vibrating diaphragm, lever and hog's bristle – directly derived from the middle ear's assembly of eardrum and ossicles – scratched this newly visualised sound into soot-coated paper on a rotating drum. Already, at its inception, captured sound found itself offered up to analytical practices due to its newfound indexical visibility: 'Sound had, according to the accepted techniques of science, to be seen in order to be quantified, measured and recorded' (Sterne, 2003, p. 45). However, as Levin (2003), Sterne (2003) and Smirnov (2013) have shown, from the middle of the 19th century through to the first 30 years of the 20th, this visibility fuelled a debate between artists, musicians, acousticians, critics and even lawyers, both in Europe and the US concerning what these scratches and squiggles (and particularly, with the advent of optical film sound, geometric patterns and even representational images) constituted. Were they a kind of writing, an expository method of display and measurement or a mutable and plastic material – a site of aesthetic transformation and potential production?[1]

In 1885, a Welsh singer and philanthropist, Margaret Watts-Hughes, entered this discourse almost unnoticed by embarking upon a unique series of experiments on the shaping of materials and images by the application of sound. In attempting to measure the loudness of her voice (one of what she considered its 'six properties'), Watts-Hughes conceived of and commissioned the making of an instrument she called the eidophone. Consisting of a mouthpiece and receiving chamber, across which was stretched a rubber membrane (Figure 1), she discovered by chance that the apparatus produced patterns in a variety of powders and fluids by way of its resonant articulation of sung notes – phenomena she named voice figures at the suggestion of her friend, Physicist John Tyndall. A desire to 'fix' these patterns directly led her to a technique whereby she applied her eidophone to coloured pigments on glass.

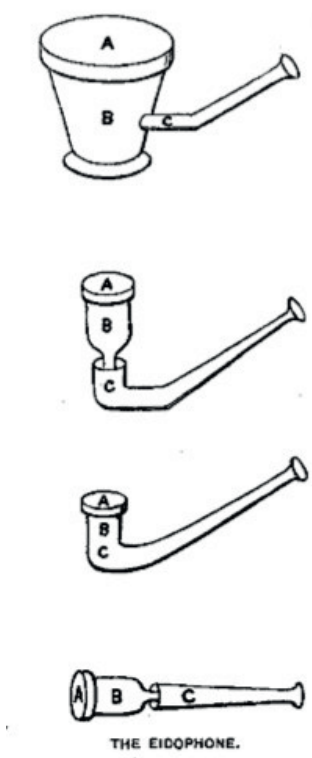

Figure No. 1. Drawing of varieties of Eidophone. The last one ('Hand Eidophone') was the kind used to make Impression Figures. *Watts-Hughes (1904, p. 3)*

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In 2016, an archive of these came to light in Cyrfarthfa Castle Museum in Merthyr Tydfil, Wales. These impression figures, as Watts-Hughes termed them, are possibly the sole remaining examples of this original, sustained and profoundly personal engagement with materials, form and voice via the employment of a mediating apparatus. This writing will attempt to evaluate Watts-Hughes' practice by proposing some possible contexts and forces that may operate within and around these singular works. By formally examining the impression figures in conjunction with her writing, this article aims to tease out an implicit interplay of gender, spirituality, voice and power at work in order to develop a contextual setting of more subtlety and complexity than the binary of art and science that is at first apparent. Further, the problems that this richness proposes when considering the possibility of 'educing' audio from the impression figures is discussed: What might we benefit from hearing Watts-Hughes' voice, even if it could be extracted digitally from these extraordinary images?

The archive

The impression figures can be divided into two general categories. One contains those which could be thought of as 'acoustically motivated': a group of predominantly blue plates which illustrate steadily voiced pitches, and which are often annotated with corresponding musical notes, including dyads and triads of intervals (Figures 2 and 3). With these pitch-driven figures, a clear gesture can be discerned. The mobile, vibrating membrane leaves striations from its trailing edge, before being removed from the glass at the end of its travel, with the centre of the membrane separating itself only at the very last – all seemingly achieved in a single fluid, combined movement of hand and voice.

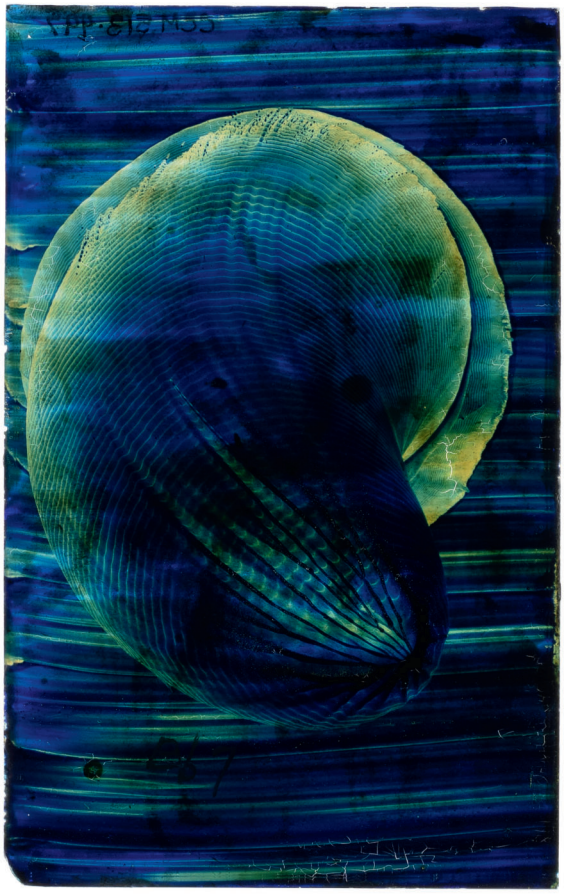

Figure No. 2. Impression Figure *demonstrating a single pitch. Dimensions approx. 150mm x 90mm*
Photograph: Louis Porter

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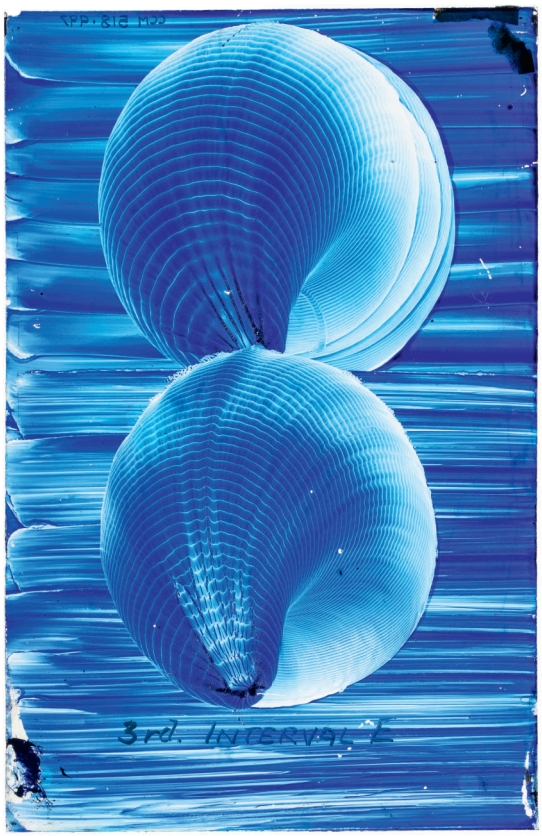
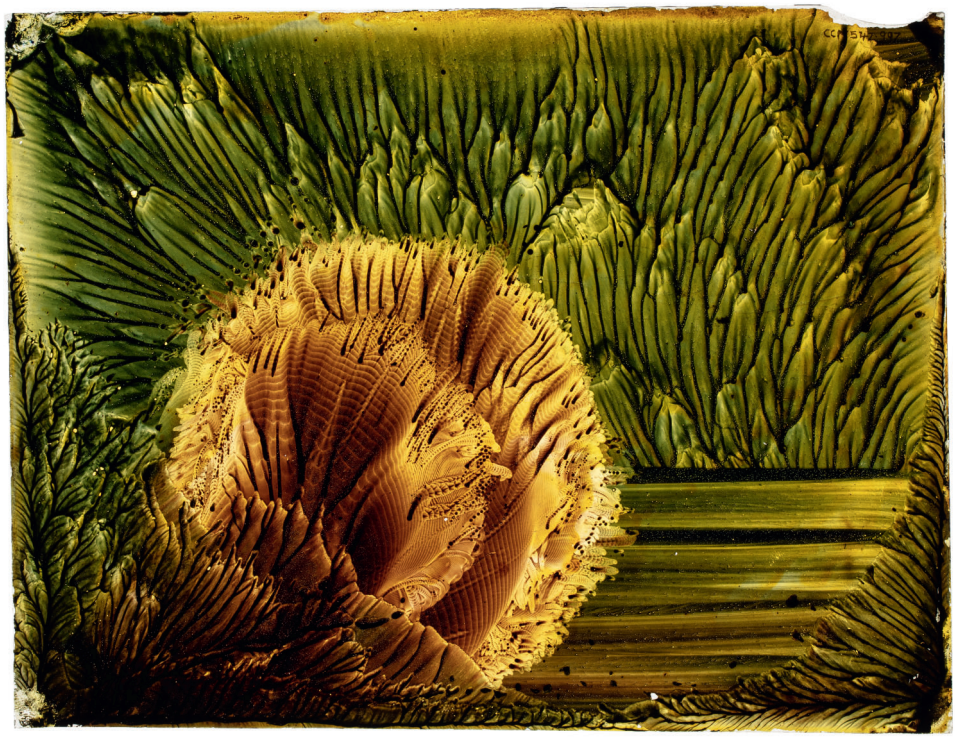


The plate and disc being both coated as before, the plate is laid upon the table, the wet colour side uppermost. The disc is now reversed, set vibrating, and, while vibrating is moved along the surface of the wet plate. As it glides over the moist surface, while a steady note is sustained, it leaves behind it a register of every vibration, recorded with the strictest accuracy. (Watts-Hughes, 1904, p. 35)

Figure No. 3. Impression Figure *demonstrating an interval of two pitches.*
Dimensions approx. 150mm x 90mm
Photograph: Louis Porter

Figure No. 4. Impression Figure.
Dimensions approx. 300mm x 250mm.
Photograph: Louis Porter



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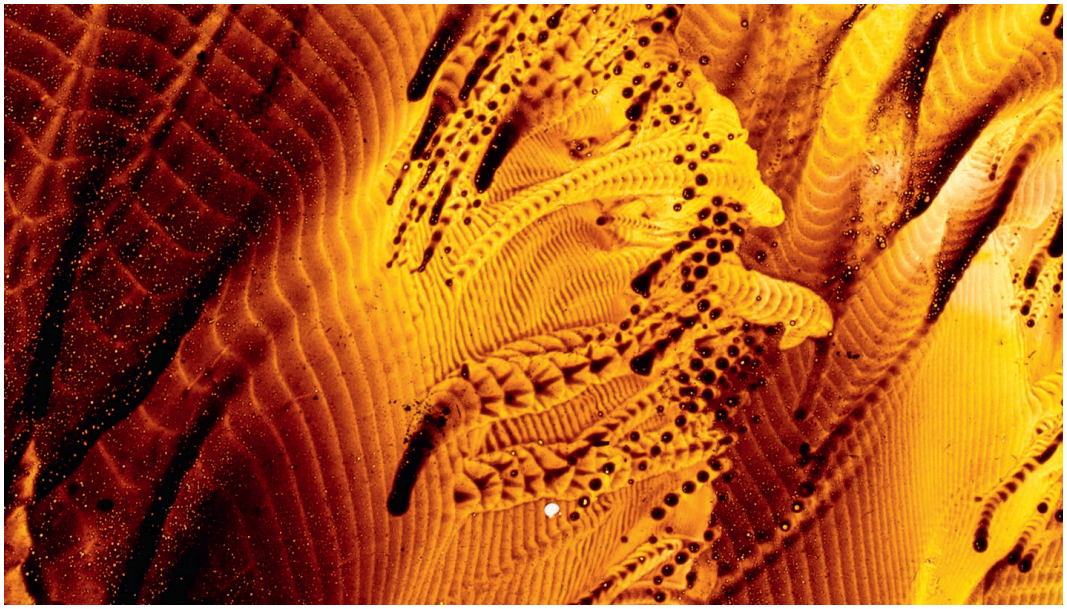
Occasionally, the pigmented side of these figures is coated in a protective layer of translucent white, perhaps in order to diffuse light so that they can be more easily studied, displayed or even projected.

The other category of figures greatly complicates the concept of visualised sound, and as we shall see, these represent the full expression of Watts-Hughes' wishes for the project, being of the approximation of, or drive towards, the representation of natural forms. Rather than recording only pitches (although a lot of these images do contain elements of pitch-derived patterns in the manner of the first category outlined above), complex reticulations and textures are smeared and manipulated across the plate in a simulation of plant-like shapes (Figure 4).

Close examination of these larger plates reveals a variety of elements in abundance. Spatters and unexpected ruptures burst from the edge of the diaphragm footprint, some of which emerge seamlessly and carry the same frequency of pattern before terminating in a darker patch of higher pigment density (Figure 5), a profusion of serpentine emissions emerging from the central figure body – visually (although perhaps not mathematically) prescient of fractal graphical production. Watts-Hughes discusses having made the eidophone in different sizes, and that, '[b]y varying the sizes of the discs, it is possible to find one to suit the lung capacity of every voice [] ranging from one inch to thirty-seven inches in circumference' (Watts-Hughes, 1904, p. 2), making the smallest diaphragm around eight millimetres in diameter. However, the size of these smaller details (as little as two millimetres across in places) marks them as perhaps originating not from a manual gesture

Figure No. 5. Impression Figure detail, showing an area of approximately 80mm by 50mm. Photograph: Louis Porter



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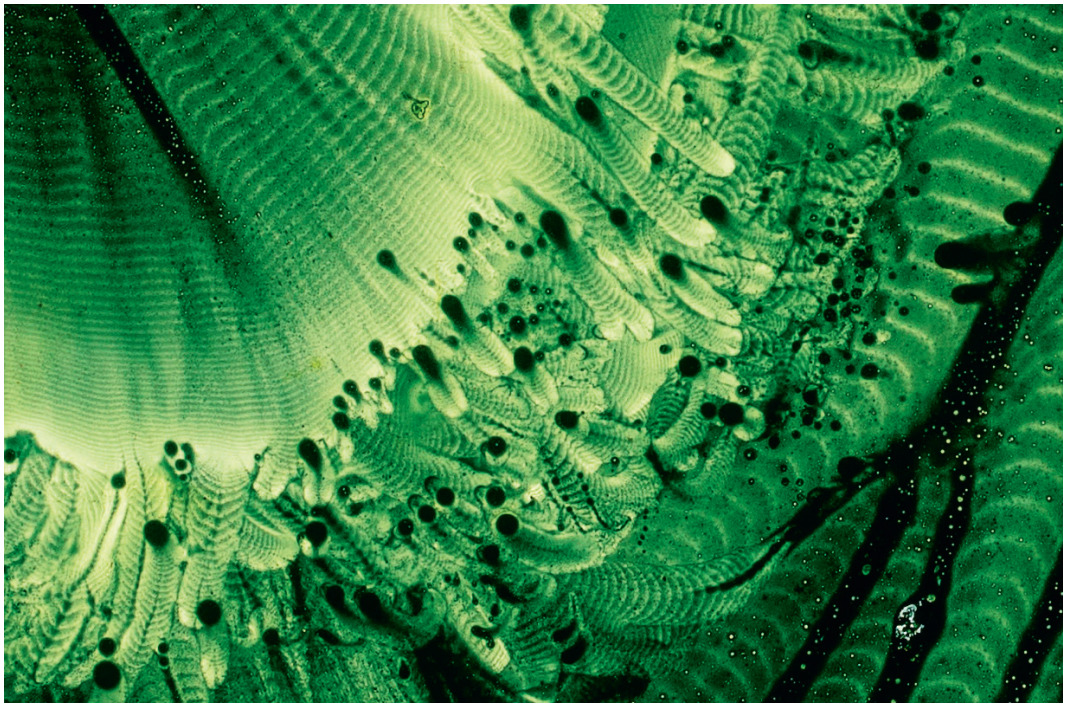
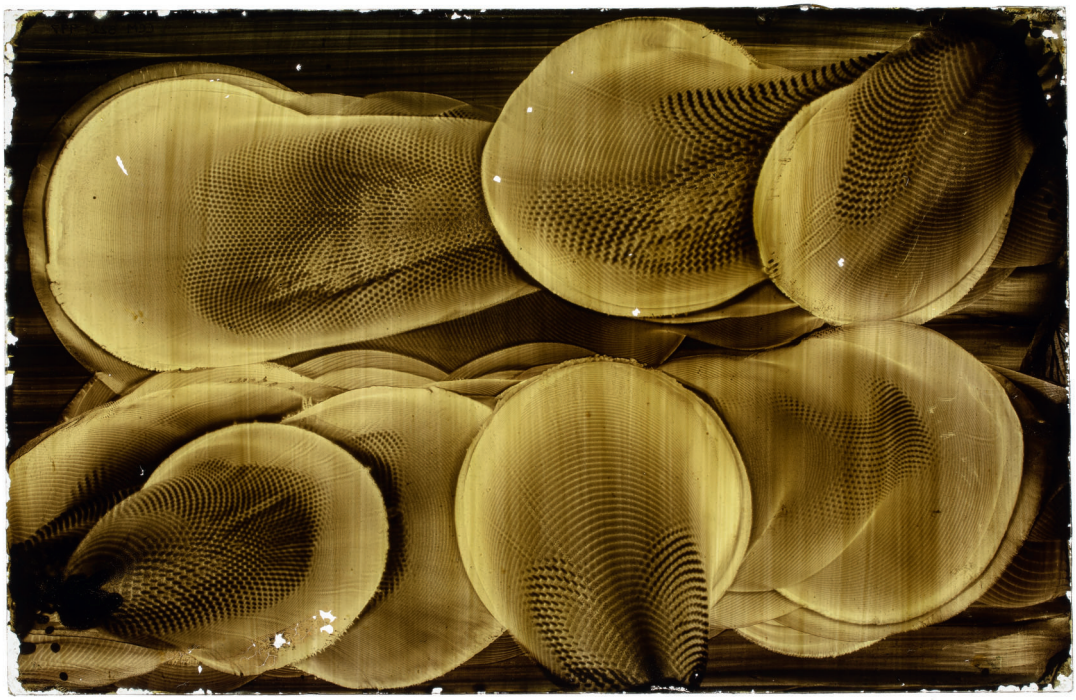


Figure No. 6. Impression Figure *detail, showing an area of approximately 80mm by 50mm*
Photograph: Louis Porter

Figure No. 7. Cross-Vibration Figure. *Dimensions approx. 350mm x 200mm*
Photograph: Louis Porter



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with a specific eidophone. Rather, it suggests an effect structural to the physics at play, whereby free-flowing drops or liquid adopt the vibrating frequency of the membrane as it sweeps across the pigment (Figure 6). Alternatively, a bulge in the diaphragm on the smallest of the eidophones may have been effected by means of air pressure, meaning that each of these details represents a manual/vocal gesture. This presents the intriguing possibility that these plates might constitute an aggregated and spatially arranged chorus of voices. Elsewhere in these images, Moiré-like patterns are sung into the pigment (these she named cross vibration figures), suggestive of the presence of overtones in her voice – likewise resolving down into a fine level of detail, derived from process as distinct from gesture (Figure 7).

Picturing a voice without words

Without a recreation of this practice, a more thorough understanding of the interactions between instrument and materials may well prove elusive, and conjecture as to the finer details of how these shapes came into being will remain just that. However, we may infer a certain amount when studying them in conjunction with her writing. In a revised publication on her work, *The Eidophone Voice Figures*, Watts-Hughes describes a programme of trial-and-error research beginning with accidental discovery, then sustained experimentation with materials (both with respect to the medium being activated and the apparatus), resulting eventually in a skilled and nuanced practice able to generate and imprint the forms seen here. She describes her original motivation as a need to measure the power of her voice – perhaps partly as a response to injury or reduced prowess – suggesting that, since visual forms were not a primary objective, the eidophone may have been retrospectively named.[2] The method employed involved adding lycopodium powder to the membrane of the device, then singing into the mouthpiece to see how far the powder leapt from the surface:

> I had been working on this path until May, 1885, when on one occasion as I sang I noticed that the seeds which I had placed on the India rubber membrane, on becoming quiescent, instead of scattering promiscuously in all directions and falling over the edge of the receiver onto the table, as was customary when a rather loud note was sung, resolved themselves into a perfect geometrical figure. (Watts-Hughes, 1904, p. 2)

These geometrical figures sit in the lower orders of a clear hierarchy, organised primarily by an increasing symmetrical clarity and visual complexity, but more importantly by way of their increased resemblance to nature, as seen in her first publication (Figure 8). Beginning with 'primitive' forms, different stages are passed through, until flower-like forms are achieved. We begin to sense a switch, in that all the diverse powers of the voice soon become deployed into the service of image

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making, rather than the formations of materials being read as by-products or symptoms of a vocal acoustic emission. A rudimentary phylogenetics[3] of forms is set out, with traits inherited from ancestors as selected for by an audio-visual sensibility guided, as we shall see, by the spiritual. In a particularly candid and revealing piece of writing describing how she sings a flower-shaped figure into existence, Watts-Hughes articulates evocatively, through a trope of opposing forces, how the volume or pitch of a sung note are only part of the picture:

> At first, when directing the voice against the semi-liquid mass upon the centre of the disc, there is a feeling as if some impassable barrier were encountered, and that it would be as easy to move a mountain with a push of the hand as to set that coloured heap moving by the action of a note. The next sustention seems only to confirm the first impression; but after several attempts one comes to feel that it could be done if only the right kind of sound could be employed. Persevering, the seemingly ponderous, inert mass is at last disturbed, and shows some susceptibility of control. Still continuing, it now begins to move, and ere comes under complete control, expanding in petals after every repeat crescendo. When the mass moves thus easily, the sensation of the singer is completely changed. The feeling is now as if all at once the air in the tube, in the receiver, upon the disc, and all around, were acting in concert for the singer's purpose, and had taken possession of every corner of space. (Watts-Hughes, 1891a, p. 17)

I quote this paragraph in full for both its evocation of a specific proprioceptive mode of engagement with voice and space, and for its gesture towards what we might think of as a 'timbral reflexivity', directed at searching for the 'kind' of sound that would produce the desired image. Watts-Hughes is writing here on resonance – attempting to describe a body-bound reality. Anyone who has sung into a tube or vessel might recognise the sense of communication between self and apparatus, whereby the internal (chest, larynx, vocal chords, head) and external lock together in sympathy with one other and, in this case, the surrounding volume of air. She becomes part of a circuit of operations and energies whereby her voice's complex of pitch, tone and power must align themselves exactly to form the conditions necessary for this revelation, of materials becoming supplicant for 'the singer's purpose'. Under these conditions, tonality – her sound – would not just be a matter of flesh, but flesh and instrument.

Understood from the perspective of bodies practising, early attempts at capturing 'natural' sound could be crudely summarised as a history of speaking loudly and steadily into apertures and tubes, with perhaps the odd song to lighten the mood. But this apparatus was required to be gently pressurised in order to achieve the impression figures, lips forming a seal with the speaking tube.[4] The hermetic system of the eidophone – or rather, its 'terminated' or muffled acoustic – sets it apart, in that it smothers any utterance. Speech and song require a leaky system or an opening to flourish through an atmosphere in equilibrium with the speaker's

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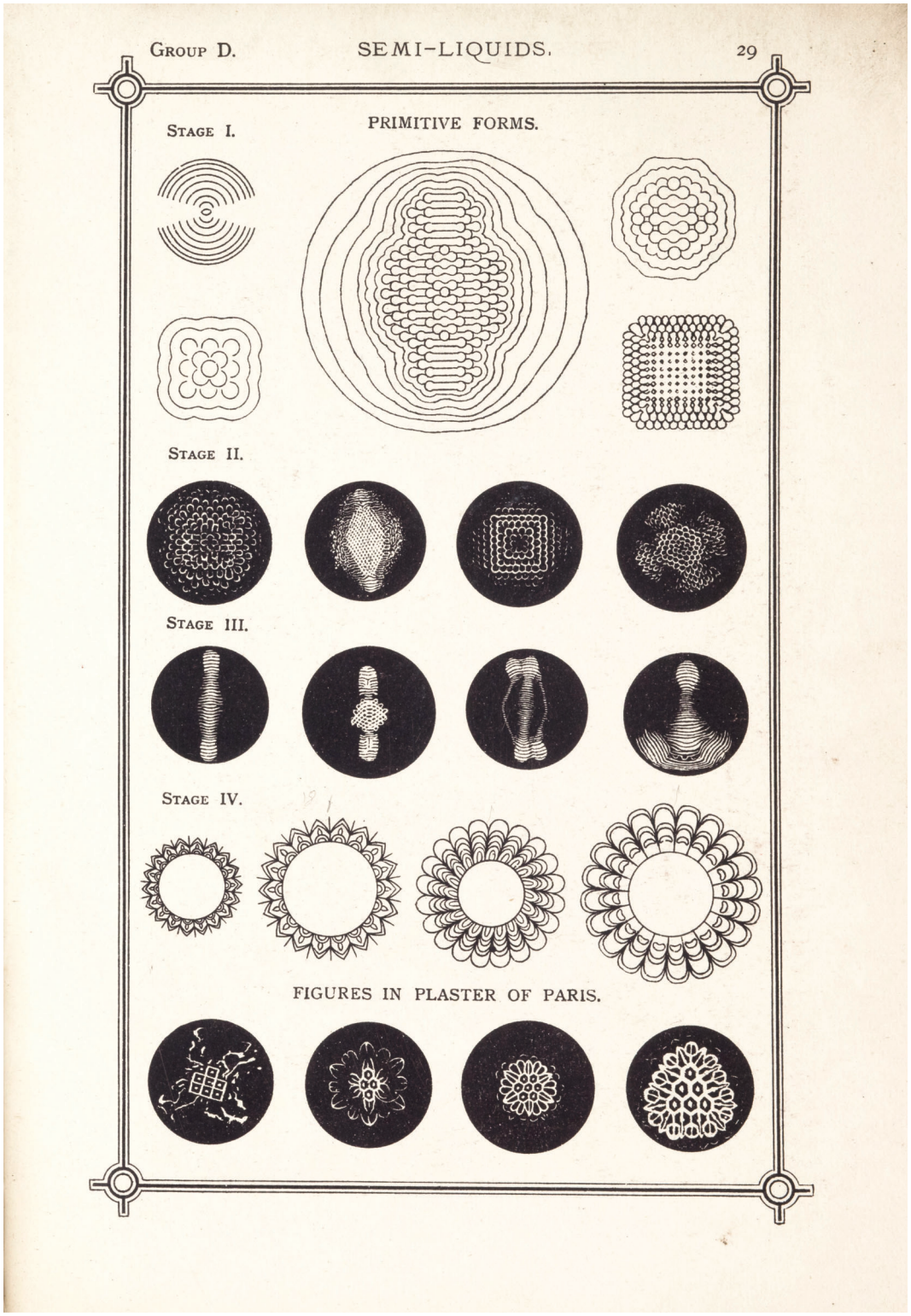

Figure No. 8. A hierarchy of forms in 'Semi-Liquid' Voice Figures. Watts-Hughes (1891a, p. 29). Photograph: The author.

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body – words must escape into the air so they can be gone, but the blockage of the eidophone's diaphragm mutes the singer, and the seal with the mouth immobilises the lips. It is telling that, in an aside, Watts-Hughes chooses the organ as the musical instrument most in tune with her feeling of the body, since its smeared, airy dynamics is free of any plucks, taps or fricatives that may evoke the noise and fuss of the sibilants and plosives of speech.[5] As the eidophone does its work, the chest and throat are valorised, but the articulating mouth is hobbled; these impression figures cannot be the remainder of words.

How, then, to listen to these material objects, if they are only tones? How might we think about the inscribed voice without words? Luminous and lustrous and vibrating with colour and texture, these works possess a nuance, movement, form and detail which place them seemingly in consonance with and across several disciplines of image making, sound performance and recording; indeed, this archive of works presents an art-historical conundrum, insofar as Margaret Watts-Hughes sat as an outlier with respect to contemporaneous institutions. She is known to have understood her work as intrinsically bound up with her Christian beliefs, while simultaneously framing it as scientific research.[6] However, an insistence on spiritual symbolic meaning in the works, as suggested to her by the former, may well have biased the reception of her work in the latter.

Her impact on the art world of the time is very limited. There is almost no mention of her research in histories of music, painting, sculpture or, latterly, moving image, and any contemporary recuperation, such as it is, has been faltering – the chief practice-led contributions being reproductions of the earlier aspects of her work by Nick Laessing and Grace Digney.[7]

From the perspective of contemporaneous image-making practices, the impression figures are almost unique when evaluated formally, but nevertheless possess some similarities to the schematics of B.W. Betts' 'geometrical psychology'[8] or the abstract hypnagogic studies of Hervey de Saint-Denys which, as Dario Gamboni has noted, presaged the thought forms of the theosophists (who were aware of Watts-Hughes' works) by some 30 years.[9] Tracing the points of contact between embryonic depth psychology disciplines, esoteric knowledge and psychophysical research by figures such as Fechner, Helmhotz and Galton, Gamboni neatly articulates the interplay between a newly differentiated sensorium as a site of research and an aesthetics of 'suggestion', where meaning in abstraction is tied to the unconscious or the numinous via perceptual ambiguities. Images which can oscillate between states of representation and noise become projection surfaces by dint of their instability. We may detect another point of inflection here via psychophysics, a gesture towards what Steven Connor has (after Kittler) described as the 'conversion mania' of the late 19th century, where energies and information were being exchanged between

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different media-sensory registers, complicating the genealogies of the devices and regimes formulated to test and facilitate such transformations.[10]

Aside from these personal and detailed descriptions of practice in her texts, little can be inferred regarding the sonic aesthetics of Watts-Hughes' endeavours. Where music makes itself known in her publication, it is only by way of illustrating how specific notes reliably give rise to concomitant patterns in the 'dry' voice figures, depicted in series above a musical stave for songs almost comically beneath her reputed abilities, such as *God Save the King*.[11] There are also remarks on how employing overtones affects a mixing of the visible attributes of whatever figures are associated with the harmonics being voiced – again, a telling indicator of her vocal prowess. However, it becomes clear that neither music nor the development of a vocal technique for its own sake was the point of the exercise, but instead the revelation of as-yet-unknown underlying principles.

In a letter to the editor of The Spectator in 1889, novelist Emilie Barrington writes enthusiastically of a visit she paid to Watts-Hughes at the orphanage she ran in Islington in North London. As a first-hand account of the production of impression figures it is valuable on its own – but just as fascinating is the breathless description of the way these works are displayed: 'Instead of blinds or curtains drawn across the lower panes of the windows, there are wonderful designs in colour; strange, beautiful things – suggesting objects in Nature, but which are certainly neither exact repetitions nor imitations of anything in Nature' (Barrington, 1889). Barrington's response is to something she describes as possessing a 'touch of fairy land', and that the impression figures 'are more like, perhaps, what a dream might make out of the impressions left by Nature, perfectly drawn designs of shell-like forms, photographically precise renderings of shapes of which the exact originals were never seen by human eye on sea or land; such things as "Alice in Wonderland" might have come upon, had she tumbled down to the bottom of the sea' (Barrington, 1889).

Perhaps in direct reference to the windows of the Congregationalist Bethania chapel at Dowlais, which Watts-Hughes considered her second home, and perhaps in consonance with what Verity Hunt describes as the era's privileging of 'magical wonder' and enchantment in educational pursuits through optics and domestic display,[12] these works seem deliberately employed to perform the function of 'illumination' in more than one sense of the word. Being aesthetically a-typical (or perhaps unique), and born of the voice rather than the hand, they require that we read them as exemplars of a spiritual/symbolic system and perhaps bordering on the divinatory when understood through their creator's writing. After all, Watts-Hughes desired that her experiments might aid 'by some slight degree, the revelation of yet another link in the great chain of the organized universe that, we are told in Holy Writ, took *its* shape in the voice of God'. (Watts-Hughes, 1891b, p. 40; emphasis in original)

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The rhetoric being employed here is very clear and embraces an old story (indeed, in the terms set out, the oldest) with respect to utterance, metaphysics and power. But here a fecund 'object voice' of tonal, rather than textual, efficacy works to incant images which reference, but nevertheless slip between the contemporaneous discourses touched on above. These forms approach nature, but seem to address something extra to it, speaking to the unreal, supernatural or transcendental.

Performing a 'spiritual' female voice

In *A Voice and Nothing More*, writing on the metaphysics of the voice, Mladen Dolar states that the omission of any *logos* traditionally problematises the voice, with respect to inherited and time-honoured Christian philosophical anxieties around vocal musicality and morality. When considering how the singing voice moves the emotions, Dolar argues that 'music is both what elevates the soul to Divinity, and a sin, *delectation carnis*. It presents carnality at its most insidious since in music it seems liberated from materiality; the voice is the subtlest and most perfidious form of the flesh' (Dolar, 2006, p. 48; emphasis in original). Dolar's dealing with the musical excesses of the voice, via Derrida, turns over and examines the originary discourses on metaphysics and notes the anxieties concerning the musical voice's ease in breaking free of its supposedly correct ontology: '[I]t holds the key to a harmony between "nature" and "culture", the natural and the *man-made* laws. Should we interfere with that sphere, everything is put into question and foundations are undermined' (Dolar, 2006, p. 44; emphasis added). Seemingly, so far, so good for our impression figures – for what else should these represent other than natural laws (read: divine) being revealed by the man-made? Well, as we have seen, the voice that created them was necessarily pitched and 'de-worded', and further to this, unsurprisingly, the above formulation is gendered.

Dolar notes that, for example, Plato's edict to ward off the decline of morals through musical excess is that '[t]he music and the rhythm must follow speech', and that forms fit for only men should prevail. '[C]onsequently one has to ban the polyharmonic instruments that permit free transitions among the modes, the "modulations," and in particular the flute "the most many-stringed of instruments". There is in fact an additional, simpler and more compelling reason for this: one cannot utter words while playing the flute' (Dolar, 2006, p. 44). A musical impediment to words (one associated with Dionysian excesses at that) was deemed fit only for women; its 'carnal' multi-modal abilities a threat to an established order.

To describe Watts-Hughes' generative vocalisations as 'musical' is perhaps challenging from a late 19th-century Western viewpoint – chants might be more accurate – and her writing on the eidophone is at most ambivalent with respect to musical expression. Steadily held, unmodulated pitches must surely have been a rarity

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prior to the advent of the mediating, recording and testing devices which required them as signal – with perhaps the exception of voice coaching (again, an analytical, vocally reflexive practice and related to the eidophone's original purpose).[13] But conversely, we have seen in her writing how these were potentially constitutive of music as much as considered efficacious for the images desired.

How, then, to reconcile the mismatch between the eidophone's input and output? How could the female, speechless voice legitimately give rise to greater truths, to 'the revelation of another link in the great chain of the organized universe'? The reading that I propose here is one of a perceived shift in power. It is that this alignment of instrument and numinous forces refigures the voice's emitting body as *also* a vessel through which to work – in a familiar trope of 'artist as channelling medium' – thereby instrumentalising the singer as a facilitator of transformation. This is not actually as egregious an abrogation of agency as it may first appear, and it bears comparison to specific spiritual practices that had reached their peak by the time Watts-Hughes began her research. If we are to engage with this practice in the round – and to find echoes of a more complete set of elements at work between artist, subject, gender and social context – then we may do well to look sideways, to the Spiritualist Church, and further to parlour Spiritualism.

In *The Darkened Room*, historian Alex Owen makes a powerful case for the 19th-century domestic Spiritualist milieu as a radical and liberalising movement of individuals from a variety of backgrounds and classes. In transgressing (albeit sometimes demurely) specific and long observed injunctions on the behaviour and interactions between the sexes and social orders, usually in dimly lit and often emotionally charged spaces, Spiritualism saw a re-examination of attitudes with respect to, among other things, gender roles in the domestic, spiritual and even political spheres. Paradoxically, the model of respectable femininity that prevailed – passive, patient, nurturing, virtuous – constituted both a challenged *and* sought-after ideal, since it provided for a psychology more suited to host or channel the 'dearly departed' with whom those assembled wished to communicate: '[S]piritualists assumed that it was innate femininity, in particular, female passivity, which facilitated this renunciation of self and cultivation of mediumistic powers. Passivity, or the lack of masculine will-power, might have been construed as that which made women the gentle, retiring creatures of prescriptive literature – but it was also, for spiritualists, the very quality that facilitated spirit communication' (Owen, 2004, p. 10).

Watts-Hughes was not an adherent of Spiritualism. However, the warp and weft of spiritual life of the era brought certain threads of Protestantism into much closer proximity than is currently the case – particularly those of a nonconformist character such as the Congregationalist (to which she was deeply committed) and Spiritualist movements. Both were constitutionally antithetic to established

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church hierarchies, choosing instead to subscribe to the concept of unmediated and personal access to the deity – in the case of the Congregationalists through the doctrine of the 'Priesthood of all believers'. The Spiritualist apprehension of the numinous was more complex, but with respect to Christianity, many believed that their role was 'to infuse new life and meaning into a religion sapped of all value and vitality [...] Christian spiritualists were often exactly those who rejected out of hand the wasteland of dogma and ritual that represented the state of their church' (Owen, 2004, p. 93).

With parlour Spiritualism, a sense of radicalism flourished within a context which enabled personas to be played out through the trope of the passive feminine vessel channelling spirits; the parallels with Watts-Hughes' practice of voicing power through the production of a simulacrum of nature seems apposite, but there is an important distinction. The flow of power with respect to Watts-Hughes' specific practice is performatively different; conscious and reflexive rather than entranced, and carrying within itself an implied, scientifically articulated *telos* of the voice, her research carved out a personal agency in new ways, however discretely. We might conceive of her being able to produce her works if (returning momentarily to the quote above) 'only the right kind of sound could be employed' as a kind of 'tuning in of the self'; on the eve of the radio era, this may well have been 'in the air'. When tracing the cultural history of the disembodied voice, Steven Connor notes that 'the late nineteenth and early twentieth centuries saw the formation of a phenomenology of disembodiment [...] The commerce between the disembodied and the re-embodied, the phantasmal and the mechanical, is a feature in particular of the scientific understanding of the voice, but apparent too in the languages and experiences of the Victorian supernatural, which coil so closely together with that work of scientific imagining and understanding' (Connor, 2000, p. 363).

Disinterring a voice

In his introductory remarks to *Pictures of Sound – One Thousand Years of Educed Audio: 980 – 1980*, Patrick Feaster tackles the question of whether certain types of early sound notations or 'recordings', such as barrel organ notations from 1778 or Scott de Martinville's phonautograph recordings from 1857, are genuinely stored audio or not. Indeed, his stated purpose in presenting these and other examples is to highlight how digital image sonification techniques infer the dismantling of certain previous hierarchies and taxons of historical stored, written or drawn audio. Could they be played back or not? Were they causally written by an apparatus or graphically represented by hand? Pointing out that a recording need not ever be played back to exist *as recorded sound* on the one hand, and that the production of purely synthetic sound that had never been recorded was now common on the other, Feaster

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attempts to dismember the palindromic causal chain (sound-recording-sound) that has generally held up such claims to validity: 'The only necessary condition is that [an image] should *represent* sound in a certain very specific way – namely, by expressing it in terms of amplitude or frequency as a function of time (Feaster, 2012, p. 2; emphasis in original). In 2008 he achieved widespread media coverage by digitally 'educing' a phonautograph recording from 1860, and this audio file and others like it can be found online.[14] What would Feaster (literally) make of Watts-Hughes' impression figures?

When handling and examining these works, one is struck by the fragility of the status of representational form within them. This varies from plate to plate, but often oscillation occurs between figuration and abstraction – always resolving entirely into the latter when diving into the images by way of magnification, letting our attention wander through newly accented forms and allowing the details to work unencumbered by the necessary physical frame of the glass which governed Watts-Hughes' broader gestures. As has been touched upon earlier, artwork which freighted in such instability could be found emerging from practices across a diverse range of disciplines – interdisciplinarity *avant a lettre* perhaps – and aspects of them do indeed 'look like' recorded audio. Vibrations manifesting as striated areas in the image, interference patterns, the impression of noise, sometimes possessing similarities to synthetic optical soundtrack experiments which were not to take place for another 20 years or so. However, the question as to whether we might extract audio from these holds within it, upon close inspection, so many considerations and variables that the seductive promise of the idea begins to fade. Educement is the drawing out of immanent forms or information – its sense is of an ideal process of revelation which presupposes an intact original, some perhaps imperfect, but nonetheless apprehensible signal which lies as yet un-decoded.

I would suggest that, aside from the least complex examples, Margaret Watts-Hughes' impression figures resist educement, maybe to the threshold of refusal. As we have seen, these images point towards a chorus of voices breaking out from others in profusion, rather than a thin line of time wrapped upon a phonograph's cylinder or spooled into a gramophone's coil, never to be in contact with itself; in this we may read a manifest mirroring of the broader contextual conditions of these works as dualistically conceived in both the scientific and spiritual.

We have seen how Watts-Hughes' practice sat across the supposed boundaries between contemporaneous disciplines of the period, while not belonging to any of them. The voice figures had no long-term impact on the arts or sciences; this despite them being shown at the Royal Society and more generally on lecture tours. Her profoundly religious understanding of the world and its articulation through song was a primary motivation in producing the works described and illustrated here, and yet we have seen how that calling – seen either on its own or in conjunc-

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tion with the simultaneously scientific characteristics of her research – is unequal to the task of accounting for the voice figures as symbolic works. As such, and given the mechanics of the eidophone in its utility as an instrument of *channelling* the energies of the wordless voice to create form, this article has also proposed that Watts-Hughes' practice may have been inconsistent with Congregationalism, but exhibited a resonance with Christian Spiritualist practices of the time and, hence, with aspects of their attendant gender-political dynamics.

It is for these reasons – technical and contextual – that the impression figures seem to problematise, or set themselves against, the contemporary drive towards the sonification of such artefacts. For if we were to overcome the technical barriers of being able to extract some kind of signal from the visual entanglements within them – where the vicissitudes of a rubber membrane of differing dimensions, mass and elasticity work upon pigments of differing viscosities (and of air bubbles, cracks and holes in the colour) – then we would be faced with a bewildering array of paths and directions to travel in. It seems doubtful that educing sound from the impression figures would reflect the richness of the works, nor the context of their making; both of which this article hopefully has helped develop an understanding of. Since in surmounting all of the above, just to get to some hallowed original, distant vocal event, then we would be listening through and past the point of the works, deaf to their abundance, in order to hear only a steadily held vowel.

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Notes

1 See Levin (2003, pp. 42-46), which is still the most authoritative and concise source on the pre-history and history of sound's visual representation and the philosophical tussles that accompanied its practical inception with the optical film soundtrack.
2 Watts-Hughes retired from public performance prior to the start of her voice figure research. The Merthyr Express notes: 'Although thus. gifted Mrs. Watts-Hughes has not found that place in the roll of musical fame ascribed to her contemporaries, a fact accounted for in a duality of obstacles, briefly summarised, Mrs. Hughes' indifferent health, and in the endowment of a deep religious nature' (Merthyr Express, April 9, 1910).
3 The establishment of relationships between entities by evaluating observed heritable traits.
4 'I found great difficulty in obtaining satisfactory results until it occurred to me to do one thing – to blow into the tube *before* singing, so that the pressure in the air in the receiver might cause the membrane to rise slightly above the level of its edges' (Watts-Hughes, 1904, p. 31).
5 Watts-Hughes, 1904, p. 4.
6 Watts-Hughes was the first woman to present research to the Royal Society, albeit under the auspices of the less formal 'Salons'. (See Martz, 2013).
7 See: http://www.gowencontemporary.com/exhibitions/nick-laessing-spatial-harmonics-and-voice2007-/.
8 I am indebted to Brian D. Mckenna for bringing these to my attention.
9 Gamboni, 2002, p. 187. In addition to a short note in *Thought Forms*, Annie Bessant mentions Watts-Hughes briefly in *Esoteric Christianity or The Lesser Mysteries*: 'Each sound has a form in the invisible world, and combinations of sounds create complicated shapes' (Bessant, 1905, p. 333). Walter Besant also provided the preface to Watts-Hughes' first publication on *Voice Figures.*
10 Connor, 2013, p. 137.
11 Watts-Hughes, 1904, 10.
12 Hunt, 2008. Referencing Brewster, the inventor of the kaleidoscope, the term 'wonder' was designated able to articulate rapt emotion within scientific discourse: 'A "wonder" in Brewster's text is at the outer limits of everyday understanding; it inspires curiosity and awe, a feeling or passion of wonder, but nevertheless it is an object of scientific enquiry'.
13 Henry Holbrooke Curtis (1919) devotes a small chapter to Watts-Hughes and the eidophone at the end of his book *Voice Building and Tone Placing.*
14 The files and Feaster's essays on early sound history can be found at: www.phonozoic.net

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