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EDITORIAL MANAGER **ÇAĞLAR ÇETIN**

In this particular volume the issue of art as interference and the strategies that it should adopt have been reframed within the structures of contemporary technology as well as within the frameworks of interactions between art, science and media. What sort of interference should be chosen, if one at all, remains a personal choice for each artist, curator, critic and historian.

INTERFERENCE STRATEGIES

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Interference Strategies

BOOK EDITORS
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KASA GALERİ

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Interference Strategies: Is Art in the Middle?

If we look at the etymological structure of the word interference, we would have to go back to a construct that defines it as a sum of the two Latin words *inter* ((in between)) and *ferio* ((to strike)), but with a particular attention to the meaning of the word *ferio* being interpreted principally as *to wound*. Albeit perhaps etymologically incorrect, it may be preferable to think of the word interference as a composite of *inter* ((in between)) and the Latin verb *fero* ((to carry)), which would bring forward the idea of interference as a contribution brought in the middle of two arguments, two ideas, two constructs.

It is important to acknowledge the etymological root of a word not in order to develop a sterile academic exercise, but in order to clarify the ideological underpinnings of arguments that are then summed up and characterized by a word.

This book, titled *Interference Strategies*, does not (and in all honesty could not) provide a resolution to a complex interaction – that of artistic interferences – that has a complex historical tradition. In fact, it is impossible, for me, when analyzing the issue of interference, not to think of the Breeches Maker (also known as Daniele da Volterra) and the coverings that he painted following a 1559 commission from Pope Paul IV to 'render decent' the naked bodies of Michelangelo's Buonarroti's frescoes in the Sistine Chapel. That act, in the eyes of a contemporary viewer, was a wound inflicted in between the relationship created by the artwork and the artist with the viewer (*intentio operis* and *intentio auctoris* with *intentio lectoris*), as Umberto Eco would put it. Those famous breeches appear to be both a form of censorship as well as interference with Michelangelo's vision.

Interference is a word that assembles a multitude of meanings interpreted according to one's perspective and ideological constructs as a meddling, a disturbance, and an alteration of modalities of interaction between two parties. In this book, there are a series of representations of these interferences, as well as a series of questions on what are the possible contemporary forms of interference – digital, scientific and aesthetic – and what are the strategies that could be adopted in order to actively interfere.

The complexity of the strategies of interference within contemporary political and aesthetic discourses appears to be summed up by the perception that interference is a necessarily active gesture. This perception appears to exclude the fact that sometimes the very existence of an artwork is based on an interfering nature, or on an aesthetic that has come to be as nonconsonant to and, hence, interfering with a political project.

Interfering artworks, which by their own nature challenge a system, were the artworks chosen for the exhibition *Entartete Kunst* (1937). The cultural and ideological underpinnings of the National Socialist German Workers' Party could solely provide an understanding of aesthetics that would necessarily imply the definition of 'degenerate art' produced by 'degenerate artists.' Art that was not a direct hymn to the grandeur of Germany could not be seen by the Nazi regime as anything else but 'interfering' and hence 'degenerate,' since it questioned and interfered with the ideal purity of Teutonic representations, which were endorsed and promoted as the only aesthetics of the National Socialist party. Wilhelm Heinrich Otto Dix's *War Cripples* (1920) could not be a more critical painting of the Body Politic of the time, and of war in general, and therefore had to be classified as 'degenerate' and condemned to be 'burnt.'

Art in this context cannot be and should not be anything else but interference, either by bringing something in between or by wounding the Body Politic by placing something in between the perfectly constructed rational madness of humanity and the subjugated viewer. An element that interferes, obstructs and disrupts the carefully annotated and carefully choreographed itinerary that the viewer should meekly follow. In this case interference is something that corrupts, degenerates and threatens to collapse the vision of the Body Politic.

In thinking about the validity of interference as a strategy, it was impossible not to rewisit and compare the image of Paul Joseph Goebbels viewing the *Entartete Kunst* (*Degenerate Art*) exhibition [11] to the many images of pompously strutting corporate tycoons and billionaires in museums and art fairs around the globe, glancing with pride over the propaganda, or – better – over the breeches that they have commissioned artists to produce.

Today's contemporary art should be interfering more and more with art itself, it should be corrupted and corrupting, degenerate and degenerating. It should be producing what currently it is not and it should create a wound within art itself, able to alter current thinking and modalities of engagement. It should be – to quote Pablo Picasso – an instrument of war able to *interfere*: "No, painting is not done to decorate apartments. It is an instrument of war for attack and defense against the enemy." [12]

If art should either strike or bring something is part of what has been a long aesthetic conversation that preceded the Avant-garde movement or the destructive fury of the early Futurists. In this particular volume the issue of art as interference and the strategies that it should adopt have been reframed within the structures of contemporary technology as well as within the frameworks of interactions between art, science and media.

What sort of interference should be chosen, if one at all, remains a personal choice for each artist, curator, critic and historian.

If I had to choose, personally I find myself increasingly favoring art that does not deliver what is expected, what is obvious, what can be hung on a wall and can be matched to tapestries. Nor can I find myself able to favor art that shrouds propaganda or business under a veil with the name of art repeatedly written in capital letters all over it. That does not leave very much choice in a world where interference is no longer acceptable, or if it is acceptable, it is so only within pre-established contractual operative frameworks, therefore losing its 'interference value.'

This leaves the great conundrum – are interferences still possible? There are still spaces and opportunities for interference, and this volume is one of these remaining areas, but they are interstitial spaces and are shrinking fast, leaving an overwhelming Baudrillardian desert, produced by the conspirators of art and made of a multitude of breeches.

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In this introduction I cannot touch upon all the different aspects of interference analyzed, like in the case of data and waves presented by Adam Nash, who argues that the digital is in itself and *per se* a form of interference: at least a form of interference with behavioral systems and with what can be defined as the illusory realm of everyday's 'real.'

Transversal interference, as in the case of Anna Munster, is a socio-political divide where heterogeneity is the monster, the wound, the interfering and dreaded element that threatens the 'homologation' of scientific thought.

With Brogan Bunt comes obfuscation as a form of blurring that interferes with the ordered lines of neatly defined social taxonomies; within which I can only perceive the role of the thinker as that of the taxidermist operating on living fields of study that are in the process of being rendered dead and obfuscated by the very process and people who should be unveiling and revealing them.

With Darren Tofts and Lisa Gye it is the perusal of the image that can be an act of interference and a disruption if it operates outside rigid interpretative frameworks and interaction parameters firmly set via *intentio operis*, *intentio auctoris* and *intentio lectoris*.

It is the fear of the unexpected remix and mash-up that interferes with and threatens the 'purity' and sanctimonious fascistic interpretations of the aura of the artwork, its buyers, consumers and aesthetic priests. The orthodoxical, fanatic and terroristic aesthetic hierarchies that were disrupted by laughter in the Middle Ages might be disrupted today by viral, amorphological and uncontrollable bodily functions.

My very personal thanks go to Paul Thomas and the authors in this book who have endeavored to comply with our guidelines to deliver a new milestone in the history of LEA.

As always I wish to thank my team at LEA who made it possible to deliver these academic interferences: my gratitude is as always for Özden Şahin, Çaglar Çetin and Deniz Cem Önduygu.

Lanfranco Aceti
Editor in Chief, Leonardo Electronic Almanac
Director, Kasa Gallery

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Interference Strategies

The theme of 'interference strategies for art' reflects a literal merging of sources, an interplay between factors, and acts as a metaphor for the interaction of art and science, the essence of transdisciplinary study. The revealing of metaphors for interference "that equates different and even 'incommensurable' concepts can, therefore, be a very fruitful source of insight." [1]

The role of the publication, as a vehicle to promote and encourage transdisciplinary research, is to question what fine art image-making is contributing to the current discourse on images. The publication brings together researchers, artists and cultural thinkers to speculate, contest and share their thoughts on the strategies for interference, at the intersection between art, science and culture, that form new dialogues.

In October 1927 the Fifth Solvay International Conference marked a point in time that created a unifying seepage between art and science and opened the gateway to uncertainty and therefore the parallels of artistic and scientific research. This famous conference announced the genesis of quantum theory and, with that, Werner Heisenberg's uncertainty principle. These events are linked historically and inform interesting experimental art practices to reveal the subtle shift that can ensue from a moment in time.

The simple yet highly developed double slit experiment identifies the problem of measurement in the quantum world. If you are measuring the position of a particle you cannot measure its momentum. This is one of the main theories that have been constantly tested and still remains persistent. The double slit experiment, first initiated by Thomas Young, exposes a quintessential quantum phenomenon, which, through Heisenberg theory, demonstrates the quantum universe as a series of probabilities that enabled the Newtonian view of the world to be seriously challenged.

> *If the measurement intra-action plays a constitutive role in what is measured, then it matters how something is explored. In fact, this is born out empirically in experiments with matter (and energy): when electrons (or light) are measured using one kind of apparatus, they are waves; if they are measured in a complementary way, they are particles. Notice that what we're talking about here is not simply some object* reacting *differently to different probings but* being *differently.* [2]

In the double slit experiment particles that travel through the slits interfere with themselves enabling each particle to create a wave-like interference pattern.

The underlying concepts upon which this publication is based see the potential for art to interfere, affect and obstruct in order to question what is indefinable.

This can only be demonstrated by a closer look at the double slit experiment and the art that is revealed through phenomena of improbability.

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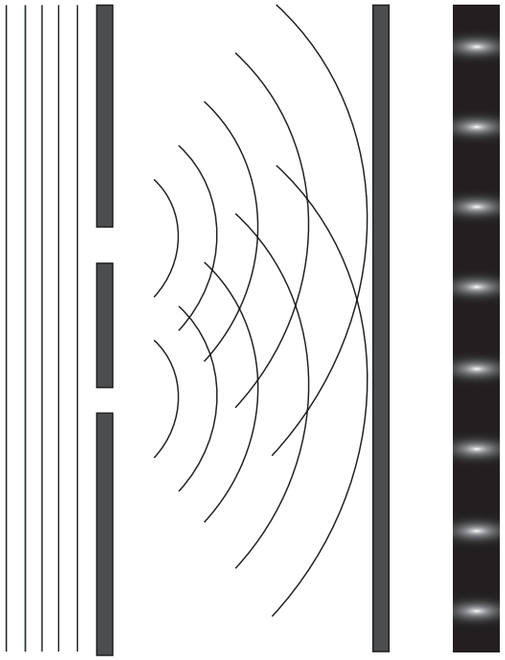

Figure 1. Diagram of the double slit experiment that was first performed by Thomas Young in the early 1800's displays the probabilistic characteristics of quantum mechanical phenomena.

When particles go through the slits they act as waves and create the famous interference pattern. The concept is that one particle going through the slit must behave like a wave and interfere with itself to create the band image on the rear receptor.

Interference Strategies looks at the phenomenon of interference and places art at the very centre of the wave/particle dilemma. Can art still find a way in today's dense world where we are saturated with images from all disciplines, whether it's the creation of 'beautiful visualisations' for science, the torrent of images uploaded to social media services like Instagram and Flickr, or the billions of queries made to vast visual data archives such as Google Images? The contemporary machinic interpretations of the visual and sensorial experience of the world are producing a new spectacle of media pollution, obliging the viewers to ask if machines should be considered the new artists of the 21st century.

The notion of 'Interference' is posed here as an antagonism between production and seduction, as a redirection of affect, or as an untapped potential for repositioning artistic critique. Maybe art doesn't have to work as a wave that displaces or reinforces the standardized protocols of data/messages, but can instead function as a signal that disrupts and challenges perceptions.

'Interference' can stand as a mediating incantation that might create a layer between the constructed image of the 'everyday' given to us by science, technological social networks and the means of its construction. Mediation, as discussed in the first Transdisplinary Imaging conference, is a concept that has become a medium in itself through which we think and act; and in which we swim. Interference, however, confronts the flow, challenges currents and eulogizes the drift.

The questions posed in this volume, include whether art can interfere with the chaotic storms of data visualization and information processing, or is it merely reinforcing the nocuous nature of contemporary media? Can we think of 'interference' as a key tactic for the contemporary image in disrupting and critiquing the continual flood of constructed imagery? Are contemporary forms and strategies of interference the same as historical ones? What kinds of similarities and differences exist?

Application of a process to a medium, or a wave to a particle, for example, the sorting of pixel data, literally interferes with the state of an image, and directly gives new materiality and meaning, allowing interference to be utilised as a conceptual framework for interpretation, and critical reflection.

Interference is not merely combining. Interference is an active process of negotiating between different forces. The artist in this context is a mediator, facilitating the meeting of competitive elements, bringing together and setting up a situation of probabilities.

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In response to the questions posed by the conference theme, presentations traversed varied notions of interference in defining image space, the decoding and interpretation of images, the interference between different streams of digital data, and how this knowledge might redefine art and art practice. Within that scope lies the discourse about interference that arises when normal approaches or processes fail, with unanticipated results, the accidental discovery, and its potential in the development of new strategies of investigation.

In "[t]he case of Biophilia: a collective composition of goals and distributed action", [3] Mark Cypher highlights the interference in negotiations between exhibit organisers, and space requirements, and the requirements for artist/artworks, resulting in an outcome that is a combination generated by the competition of two or more interests. As part of the final appearance of *Biophilia*, the artwork itself contained elements of both interests, an interference of competing interests, comprising a system in which the artist and the artwork are components, and the display a negotiated outcome. Each element interferes with itself as it negotiates the many factors that contribute to the presentation of art. In this sense the creation of the final appearance of *Biophilia* is the result of the distributed action of many "actors" in a "network." [4] (To put this in another form all actors are particles and interact with each other to create all possible solutions but when observed, create a single state.)

In summing up concepts of the second Transdisciplinary Imaging conference, particularly in reference to the topic of interference strategies, Edward Colless spoke of some of the aspirations for the topic, entertaining the possibilities of transdisciplinary art as being a contested field, in that many of the conference papers were trying to unravel, contextualise and theorise simultaneously.

The publication aims to demonstrate a combined eclecticism and to extend the discussion by addressing the current state of the image through a multitude of lenses. Through the theme of interference strategies this publication will embrace error and transdisciplinarity as a new vision of how to think, theorize and critique the image, the real and thought itself.

Paul Thomas

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TRANSVERSAL INTERFERENCE

Texts have recently shown themselves to be inaccessible. They don't permit any further pictorial mediation. They have become unclear. They collapse into particles that must be gathered up. This is the level of calculation and computation, the level of technical images.

— Vilem Flusser, *Into the Universe of Technical Images* [1]

by

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Inserted into *The Pencil of Nature* (1844) and *Sun Pictures in Scotland* (1845) – collections of the first commercially published photographic plates – William Henry Fox Talbot placed an inscription, which called for a jump cut in the perception of recorded images:

> *The plates of the present work are impressed by the agency of Light alone, without any aid whatever from the artist's pencil. They are the sun-pictures themselves, and not, as some persons have imagined, engravings in imitation.* [2]

In effect, what Fox Talbot added in *after* publication was a modulation of the *pre*conditions for facilitating the emergence of a photographically entangled visual perception. His insertion attempted to immediately

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ABSTRACT

Increasingly, the images we regard as authoritative – those with a seemingly direct relation to the 'truth' of our brains, profiling our identities, or mapping our universe – are not generated optically. They are composed out of other media, notably sonic and electromagnetic materialities, and other processes, primarily algebraic and statistical transforms. In actuality they are transmaterial *assemblages. Yet such heterogeneous image entities continue to command the epistemological privilege of indexicality that light-based images previously claimed. If the scientific, authoritative image is already constituted 'transgenically,' what implication does this have for interference as a viable aesthetic strategy? To what extent can artists and cultural producers visually interfere with the politics and ethics of such imaging practices? This article suggests that we should abandon the strategy of interference as* intervention *in favour of a better understanding of interference as pattern, indeed fabric, subtending many contemporary nonvisual imaging practices. I argue for a transversal* diagrammatic *approach to the nonvisual image; to diagramming as both a holding together* and *a dynamic deformation of images into new assemblages. In turn, such diagrammatic practices reflexively remind us that what we see as fixed and authoritative images are instead processual, virtual and speculative modes of 'viewing' and engaging life.*

condition this modality so that perceptual distinctions would be made in relation to the different materialities deployed in the inscription/recording of images.

Fox Talbot was a component of – both engaged with larger machine flows and actualising through various techniques – the event of technical images. He became enmeshed with what was to become a new 'diagram' of visuality, co-extensive with the socio-historical field that, among a number of novel inventions, helped to create scientific photography. As I will argue, building on recent work that I have published on diagrammatic events and functions, especially as these unfold in a technical dimension, a diagram is

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an abstract assemblage of relations. [3] Abstractly, this relational assembling pulls together the conditions under which nonhuman and human elements conjoin, play out historically, and inflect across social, aesthetic, political (and more) registers. A diagram is also always open to and conditioned by an 'outside.' Outside-in, yet crucial to its capacities to differentially transform, the diagram's tensors are its potential to deform, explode, shift or inflect toward indeterminate conjunctions. Today that diagram, which once conditioned the event of the technical image and the experience of a photographically inflected visual perception, is undergoing palpable encounters with its outside, now exceeding what was within and resulting in new conjunctions. We are experiencing images that are no longer visual and visual perception becomes a process of composition that is fundamentally transmaterial and transmodal. The technical image is now diagrammatically traversed by an intensive *interference* that arrives from elsewhere.

But if this interfering outside were somehow already insinuated in technical images (the interfering immanent materiality of those "sun-pictures themselves"), what does this say about the curious diagrammatic onotogenesis of technical images? Although Fox Talbot's phrase "the pencil of nature" has become synonymous with an understanding of the indexical relation between the world and optical photographic processes, this phrase, at least in its usual indexical deployment and understanding, curiously elides these diagrammatic events conditioning images. Yet what we also sense from his after-insertion is something more direct that must be expressed: the page lit immediately by the sun image. Plates, which have the capacity to be materially affected by light travelling cosmically as both or either waves and particles; metal plates that, at a molecular level, have conjoined with the sun itself. And in this conjunction we have something novel, something gloriously aesthetic – albeit a nonhuman aesthetics – a base metal to cosmological directness of the photographic image, making a machine for expression without requiring the artist's hand. Yet as is often argued, Fox Talbot's "pencil of nature" and photographic plates were intended to demonstrate the deep and objective coalescence between the new means for recording and making images and that new instrument of science, the photographic camera. [4] What to do, what to say, about all this intensity, then, that seems to offer something more than objectivity yet not at all subjective?

Quite dramatically the sun-picture, the camera, the plate diagram cobble together the rudiments of an assemblage, a machine for producing an aesthetic-technics at once artistic and scientific. This art-science proximity – sometimes loosely hanging out, sometimes in tension – nonetheless accompanies the descent of imaging, from photography onward, into what Vilem Flusser has called "the universe of technical images." [5] It is not the case, then, that the technical image breaks away from an aesthetic register – as Fox Talbot's supplication to "sun-images" all too poetically attests. Instead, the relations between the scientific and aesthetic have to be constantly renewed with respect to the question of indexicality, as if the imprint of the world – the affective proximity of materialities and their forces – will always threaten to interfere with the image's claims to either science, on the one hand or art, on the other.

What Flusser makes clear is that what the technical image ushered in – not with the optics of photography but via the programmaticity of the camera as apparatus – was a new mode of dealing with the relational forces of different materialities con- and disjoining domains such as art and science. Images came to be semiotized through the process of their (eventually) endless recording – the camera a kind of program that both enabled and sequenced that recording. Eventually the sun-picture would become so recordable that it has come to almost shoot itself, holding up a back camera to itself as its own source of light. The contemporary plethora of imaging of the image-itself results today in a purely nonhuman technicity for the entire visual field, where the data/image relies on code and program for any semiosis whatsoever. We see this nowhere as clearly as the transcoding of data through scientific and medical visualization. Yet as Flusser also suggests, this does not mean that materialities of the image or text disappear. Instead, as the relations between texts, images, code and symbols historically mutate, so too do they materially transform. Encoded through binary semitotizing regimes, the new materiality of text implodes into zero-dimensionality. [6] Surprisingly, it is on the zero-degree plane of the electronic encoding of image as data that visuality now pins its hopes. Its index, and 'authority' is no longer the natural world but a universe of pure mathematics.

With this broader deformation and sense of the image's aesthetic, sociotechnical diagramming and transformation in mind, I want to approach this newer 'technical' indexicality of the image now via a series of propositions. First, that the fabric of the image within scientific and medical arenas while seemingly abstracted from the natural world's 'pencil' is nonetheless fundamentally transmedial and transmaterial. Second, that we are undergoing a seismic shift in optics, which cannot simply be understood chronologically as an historical shift from optico-chemical techniques of recording light's properties to computational encoding. Rather the visual field itself is undergoing a re-orientation driven by sensing *invisible* phenomena. This is not captured by the common conception that the invisible is being made visible, as is often claimed when data visualisation is explained, lauded or marketed. Instead, invisibility itself has become an *optical phenomenon* within the domain of the visible. In turn, this suggests that optics has undergone radical and fundamental transmaterial, transmedial and *amodal* transformations. I want to spend some time grappling with at least some of the scientific aspects of such changes.

Caught up with both these propositions are certain consequences for how artistic practices will need to strategically reposition themselves in this new domain of technical invisible phenomena. A common tactic of artistic intervention into data-based or data generated material has been to 'interfere' with the smooth encoding of the image, often by seeking to introduce, unearth or trigger corruption and/or noise within the data. If data generated images somehow suggest the presence of a perfectly functioning objective and scientific program or machine numerically crunching away, then the artist must bring the image back down to earth or so it goes: "Glitch art is process art: the artist's hand intervening in digital data leaves its mark in the visual essence of the image." [7] Thus the image bears the trace of material aesthetic presence as an interference performed at the level of a "glitchy" gesture. We seem to be in inverse Fox Talbot terrain: the data-generated image is so abstracted from the material world that now the artist's body must materially intervene.

We see a return to a certain kind of indexicality via a strategy of interference/intervention, here weighing in on the side of the aesthetic, body and process against the digital, numerical order. But, as I will argue throughout this article, interference can no longer be aligned with the aesthetic, and is not easily available as an artistic tactic in the contemporary universe of data-generated technical imaging. And, moreover, the data-generated image is already deeply traversed by nonhuman *material* patterns of interference. My third proposition concerns these states of affairs and consequently asserts that interference is already incorporated as a condition of the event of the (scientific) contemporary technical image. In this context,

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interference provides a diagnostic ordering – an interpretative structuring pattern – responsible for generating a range of contemporary scientific imaging from the very near to the very far; from biological microscopic interaction and development through to astronomical images of plasma nebulae emitted by black holes.

I want to spend some time with these propositions, stepping through the ways in which each of these are unfolding in the domains of scientific and medical visualization. It is important to become 'practically' familiar with these monumental changes in the material and relational fabric of imaging today. It is important to gain a sense, especially, of the taken for granted transmateriality of the image and of interference patterns as foundational for images as they are produced throughout the sciences. Tracking both transmateriality and interference seems a necessary first step in tweaking or even resetting aesthetic strategies and tactics in terms of the ways in which scientific images gain authority as they circulate through aesthetic and cultural domains. If we take into account the shift I have signaled toward an optics of the invisible, along with the role of interference as diagnostic ordering, then we will inevitably also raise questions about the status and politics of whole areas of aesthetic endeavour such as 'practices of visualization' and even 'visual studies.' Much art-science and even much nonscientific contemporary discourse about the visual misconstrues a number of the directions taken by scientific imaging, taking, for example, 'visualization' to be one of science's main aims. Concomitantly, aesthetic discourses come to adopt a program, which actually miss what the sciences might more radically offer. That is, they miss a kind of speculative imagistic trajectory that inhabits many visual scientific endeavours oriented toward a fading of visibility, indexicality and illustration as imperatives for the scientific image.

Interestingly though, a range of cross-media art practices are also engaged in loosening these imperatives rather than in shoring up the materiality of the artist's presence in an immaterial informatic domain. Indeed some practices that specifically engage with the authoritative status of the scientific image amplify or intensify the transmaterial and transmedial relations permeating scientific imaging. This is a deliberate aesthetic strategy for unknotting the authoritative status within scientific imaging and needs to be tagged. Other aesthetic practices are concerned with the nonvisible but have displaced it, transversally, so that the dominance of the visual begins to fade. I will gesture toward some of these aesthetic practices in tandem with my unfolding of the above propositions about transformations to the scientific image. I hope to signal that a different aesthetic event – not movement or genre but more process – is emerging, which I will call 'diagrammatic'. To be open to this aesthesia, we might have to re-orient entirely...away from the 'visible' *per se* toward something I will tentatively name the imperceptible. This is already coming into expression diagrammatically through the transversality of such cross-media artistic experiments.

First a note on my use of the term 'transmateriality'. By this, I do not mean innovative 'materials' from plastic through to digital fabrications that bring about transformations in culture or society, as is suggested by, for example Blaine Brownall. [8] The problem with this elaboration of the 'trans' is that materiality itself remains unaffected by its 'trans'ing; its movement across and between itself and the socio-technical, ethico-aesthetic components with which it conjoins and separates to form and deform. In Brownall's account, 'material' seems to possess properties *to innovate*. Yet we are more likely to find that the material properties of the image such as 'light' considered as wave and/or particle are in fact already *transformed* by very material movements. Such movements are not slides across but rather transductions between different energetic forms. It is precisely by transducing

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that 'an image' such as a Magnetic Resonance Scan is produced. Hence what I am referring to as transmateriality operates *prior to* any individuation of 'a' material. The transmaterial image is an image whose optical qualities are not so much properties but rather artefacts of the transduction of nonvisual materialities and relations. As we shall see, 'relations' here are to be taken seriously in the functioning of materialities – in their *materialization*. For it is the various relations that dynamically hold between and across ('betweenness' and 'acrossness' *are* relations) light, sound and algorithmic transform, for instance, that crystalize to become the transmaterial scientific image. Transmateriality, then, is a metastable process that *precedes* any given material individuation. It exists virtually, in the Simondonian sense, signalling the potentialities that certain materialities might become, might actualize as, as a result of a transformation of those potentialities in the direction of a structuration. [9] But it is also processual, actual – the movement toward materialisation, individuation, singularity. The relations engaging and engaged by transmaterial processes, then, are both the metastable, virtual ones of pure difference *and* the actualizing ones of a 'thingness' as it assembles. We could develop a conception of transmateriality as a general condition of imaging itself but that is beyond the scope of this article. Instead I intend to be more concrete with respect to the transmaterial conditioning of authoritative scientific images.

Let's begin by probing a little into one of those familiar scientific images of interiority that claim to index the biological basis of human behaviour: the fMRI of the human brain. What does an fMRI actually visualize? The areas of 'color' converted from the original grayscale image are a 'capture' of cerebral hemodynamic response – we are looking at the surplus of oxyhaemoglobin (oxygenated blood) remaining in the veins as a ratio of the increase to decrease of cerebral blood flows. Before asking 'what,' we should ask 'how' does an fMRI visualize? We should be clear on one thing – an fMRI is not a *visually generated* image. In fact, in order to become image, what is required is the conversion of non-visual data into image space. Like MRIs, fMRIs measure the combination of magnetic signals emitted from hydrogen nuclei in water from the area of the body being imaged (magnetic resonance). Magnetic field gradients are captured in the scanning process, and their frequencies and rate of change are related to the position where the signal is picked up by the scanner. The magnetic signals captured – in fMRIs these are emitted over time as the cerebral blood flow changes in response to stimuli – are composed of a series of sine waves, with individual frequencies and amplitudes. These frequencies and amplitudes are computed using a process called the Fourier transform, which converts signal from the time domain into the frequency domain. The frequencies are then separated out and their amplitudes are plotted as an image. A number of manipulations in the Fourier transform space that allow for smoothing of the final image data, elimination of noise via, for example, high pass filters and so forth, take place before the 'image' of an fMRI is generated. What is being scanned and then what is done computationally to the signal captured are in fundamental ways non-visual and the image/s we eventually see map the *rate of change as a function of time*. What we are looking at, then, is first and foremost a temporally imputed imagescape. As Joseph Dumit has suggested, functional brain imaging at its constitutive level should not be confused with morphological images of the brain, even though such images appear to generate a sense of the brain's topography. [10]

The areas of 'colour' we often see are converted from gray scale in the original imaging, map a 'capture' of cerebral hemodynamic response. We see the surplus of oxyhemoglobin (oxygenated blood) remaining in the veins, measured as a ratio of the increase to de-

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crease of cerebral blood flows. Active neurons require both glucose and oxygen in order to fire and an fMRI traces the flow of blood transporting glucose and oxygen through the vascular system necessary for firing. But are we seeing the trace of the activity of neurons themselves, for example, or are we seeing the trace of activity caused by neurotransmitters, which likewise require cerebral blood flow? An fMRI cannot distinguish these substantially – it is a mapping of oxygenated blood flow; that is, of process not substance. So, we are looking at a mathematically inflected (the ratio of increase to decrease), re-coloured, afterimage selected out of dynamic processuality. Interestingly, the more the fMRI becomes visual artefact (and especially when it is framed as 'an' image or even two comparable images), the less visually indexical it can be said to be, given that its initial data comprises signal generated by electromagnetic waves. As 'an' imaging of the brain, then, we need to understand the final startling brain 'images' of so-called located emotions or as evidence of rewiring less as things being imaged and more as temporally inflected (data)sets made up of cross-processed transmaterialised signal. What is important in this cross-processing is that relations between data variables such as frequency, amplitude and position are maintained.

But the fMRI corralled into 'demonstrating' neural correlation of behavior has become rigidly indexical, losing the potential for the brain to again change in response to, for example, less exposure to media, exposure to noise in the street, a quick decision to not lie or just to *change ad infinitum*. It has instead actualized according to a regime of truth, which is *held together by a particular diagram of power*. [11] A diagram – and here I am following the concept of the diagram laid out by Michel Foucault, especially in his work on disciplinary societies – that continues to hold together the relations of force of our visual regime. These relations are co-extensive with an entire social field of securitization and control – relations such as correlation, identification, visibility and so forth. What we need, then, is a way to perceive such neuro-images as part of that diagram of relations of force – relations that are co-extensive with a visual regime connected to securitization and control but also to sense that those relations are open to deformation. [12]

My second proposition asserts that a shift in optics is occurring re-orienting that field toward invisibility as an optical phenomenon in and of itself. [13] For many of us, this seems to suggest a kind of paradox insofar as our optical devices – eyes – deal with the visible spectrum of light behaviour, which in terms of wavelength, sits in the range of about 380 to about 740 nanometers. But there are also ranges of nonvisible (for the human) electromagnetic radiation. We are of course already familiar with optical devices such as night vision glasses that generate visibility for humans under normally nonvisible conditions. We have been experiencing a steady increase in technical applications that render the 'invisible' visible. But my proposition here concerns a vector in the opposite direction – the generation of visible invisibilities.

Contemporary art practices are likewise engaged with rendering the nonvisible through inventive techniques and explorations of media. But perhaps the focus for artistic activity in this sphere is less rendering the invisible and more a shift toward non 'optico-centric' contemporary aesthetics. In David Rokeby's *Dark Matter*, first exhibited in 2010, a sonic sculpture permeates a completely darkened space, waiting silently for participants to activate it. [14] Participants must reach out with their hands to shape or sculpt the sound so that it comes into existence through the space. The experience of the work is entirely nonvisual – participants engaged in auditory-kineasthetic-tactile and proprioceptive relations throughout the piece and darkness envelops them.

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Interestingly enough, though, *Dark Matter* does not reject the visual; we get a sense of this through its composition and design. Infrared video cameras are positioned within the gallery space at four points. They gather positional data based upon a software division and mapping of the space into thousands of three-dimensional zones. Rokeby has selected a range of these zones and has attributed sound behaviours to them. The data from the cameras is cross-referenced, calculating which zones are experiencing the greatest physical activity by participants at any given moment and then the installation plays the sounds linked to those zones throughout the speakers in the space. At both the level of the system hardware and at the level of artistic composition, Rokeby provides us with relations to visuality, all the while composing a work that is fundamentally nonvisual.

Throughout the corpus of his work, stretching back to the early 1980s, Rokeby has been interested in nonhuman vision systems especially infrared cameras and their potential to "survey" an audience involuntarily. [15] In thinking about such vision, he invokes the ancient Greek notion of the eyes beaming "rays of perception" outward to the world rather than receiving images onto the retina**.** Additionally, he comments upon the design process of attributing sound behaviours to various zones in the room: "They were 'painted' into the space by hand. Starting with an empty space, the artist placed the sounds in the space by selecting a sound then waving his hand in a particular area to locate the sound." [16] Rokeby reconnects the optical via gesture to painting and its permeation by the haptic. This resonates too in participants' experiences of the space as they reach into the "painted soundscape" to "touch" the invisible sculptural curves and dimensions. Furthermore, the title of the work refers to that ineffable, unknown astrophysical phenomenon, which can only be inferred from its gravitational effects on *visible matter*.

Rokeby works to expand and dissipate the visual field in order to push us into an arena in which visuality loses its hitherto privileged status based in part on the socio-political anthropomorphism that holds between visuality and the hierarchy of the senses in human perception. In Rokeby's installation, visuality becomes instead a field in flux: a property of the machine; something to be evoked in a transdisciplinary relational manner; and ultimately only inferable. As we participate with *Dark Matter*, we come to inhabit a space in which by taking away visibility the visual field relaxes, taking on a more relational, diagrammatic feel where it can be modulated and inflected via multimodal and multisensorial deformations. This points to a really radical opening of contemporary aesthetics toward a direction quite different from that prescribed by, for example, a "visual culture approach," which, despite its claims for interdisciplinarity, still argues for the determining role of the visual in the wider culture to which it belongs. [17]

Rokeby's aesthetic invention of a diagram for a sonic-haptic space, which nonetheless holds itself in relation to the visual, is light years ahead at the level of a sociotechnical diagrammatic shift than the shift into invisibility optics currently gathering speed in scientific research. Research into 'metamaterials,' for example, has intensified around phenomena such as invisibility cloaking. [18] Metamaterials are artificial materials that can only be described in terms of the system of relations that adhere between atomic or sub-atomic elements rather than the properties inherent or attributes of the materials themselves. Some materials are characterised by their 'periodic structures' for example; that is, their system is formed through self-impositions of the material elements that generate displacements. Such displacements can exhibit optical properties not found naturally. An electromagnetic metamaterial affects electromagnetic waves by having structural features smaller than the wavelength of the

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respective electromagnetic wave. Metamaterials sit over or around an object, guiding or scattering electromagnetic waves around or away from it, creating an illusion or cloak of invisibility. Currently, experiments have only been successful with the microwave spectrum and at a very small scale so actual *visible light* invisibility is still some way off but researchers are hoping to break the light barrier soon.

Although we might applaud this kind of research as it seems to signal an exciting shift toward the invisible, we have only to look at the major applications (and of course funding institutions) at the core of such innovation: the US military and NATO. The military fantasy surrounding these new materials lies with the dream to build entire ships, planes and spy satellite systems enveloped by invisibility. In the meantime, both institutions are already developing applications for remote sensing devices, antennae, cloaks for counter-detection and electromagnetic shielding applications among a growing host of surveillance and missile related projects. [19] This is hardly surprising but it does provide a clear signal that the diagram of power relations to which an invisible optics continues to belong is still one of securitization and control. As it turns out, then, invisibility is as much bound up with the socio-political forces of a regime of force relations that organise to maximise opportunities for societies of control. If, as Kevin Heggarty and Richard Ericson' observed in 2000 that a new surveillant assemblage had emerged functioning around the "disappearance of disappearance," then we are now experiencing its flipside: a *reappearance of disappearance*. [20] The scientific shift to invisibility within optics participates in a diagram of force relations in which perception is also captured and redistributed, oscillating now between the visible and the hidden. This diagram is co-extensive with an entire social-technical field of techniques for pervasive profiling and sensing. But Rokeby's aesthetic uptake of the *non*visible finds a different inflection point in this diagram and moves it somewhere else. While the visual continues to play a role in cross-media art works such as Rokeby's *Dark Matter* for example, a different sensing of the visual is also made available that takes into account nonhuman vision systems and a redistribution of the usual hierarchization of human senses.

But the emerging optics of invisibility within scientific research into metamaterials also raises another aspect of the composition of imaging. This aspect holds equivocal possibilities for the political and social directions of both art and science and hence impacts upon the ways in which both come to participate in a particular diagram of power. The (meta)materialist effect of cloaking an object in 'invisibility' works because the materials are themselves comprised of components that have small inhomogeneities. The differential summed response across these components allows the parameters of the electromagnetic wavelengths hitting the object to be variably manipulated. In general, then, (and I am being quite reductive here for the sake of brevity), metamaterial-cloaking produces *interference patterns* across the spectrum of electromagnetic waves, resulting in an 'image' of invisibility. Furthermore, the actual generation of metamaterials themselves out of components often takes place as a result of processes that deploy interference patterns such as "interference lithography." [21]

Put briefly, interference is a physical phenomenon where waves superimpose to form a resultant wave of greater or lower amplitude. Without spending too much time cataloguing and explaining the importance of this phenomenon for the production of a wide range of scientific images, I do want to note at least a few of these: astronomical interferometry (used in, for example ,Very Large Array telescopes to increase the strength of the electromagnetic signal received), bio-layer interferometry, which I alluded to at the beginning of the talk, used in differential interference contrast microscopy to look at *in vivo* cell structure and development; interferometric techniques used in software to adjust imaging the motion-tracking of three-dimensional objects.

Physics, it can be surmised from this range of applications, conceives interference more generally as a phenomenon and then technique for generating a diverse range of scientific imaging from the mid-twentieth century onward. Here interference is understood as pattern rather than as subversion or intervention. We need to at least take heed of this understanding if we are to seriously engage with the composition of the contemporary image. That does not imply simple acquiescence to the scientific framing of interference as orderly rather than ordering. In other words, we do not need to adopt the orderliness of pattern as *the necessary value* to be derived from interference phenomena. There is a tendency by both artists designing for interaction and in the current discourse around interactivity to want to resolve machinic or participatory interference phenomena in the direction of harmony or co-operation, that is, a kind of 'order.' To return to *Dark* Matter, for instance, Rokeby speculates that when multiple participants are present within the *Dark Matter* space, the cacophony of sound produced will lead to a situation where no one knows who or what is controlling the sound. [22] Rokeby speculates that order will emerge form this situation as a result of co-operative interaction between participants, who will tend to work toward the creation of a "resolved," orderly, sound sculpture. Yet anyone who has watched participants engaged in artistic interactive installations will quickly note that co-operation is a learned behaviour not a naturally recurring result; chaos, surrender and sometimes futility are quite often more common.

What I am suggesting is that higher-level homogeneity or equilibrium is not the necessary outcome, especially not a required or desired *aesthetic* outcome, of component inhomogeneous interactions or, to adopt a more sympathetic socio-political term, heterogeneous relationality. In terms of potential aesthetic strategies for dealing with the growing importance of interference as a scientific diagnostic and imaging technique, we might steer a more interesting course than to fall into one or other side of the pattern versus disruption debate. In *Interference*, a web work made in 2008 by Michael Kargl (now inactive), the aesthetic premise starts with a questioning of the homogenising tendencies of interference as pattern within the domain of networking. [23] The image which loads for the start-up page of the work immediately directs us to a scientific representation of waveform interference indicating that we should take interference phenomena seriously as they general phenomena from pharmacological interactions to linguistic transformations. Interference as a generalised experience of concurrence and overlap is the premise, then, for Kargl's work. The point of creating such a work *online* is precisely to deal with online networks as participants in just such a concurrent mode of making and consuming the visual and the aesthetic. To place art online is exactly to make it available for interaction everywhere and for everyone concurrently. But should we accept this as the necessary condition for viewing, Kargl's work asks? What is viewed, the visible of the work, in fact disperses and dissolves itself back into its inhomogeneities. Or in terms more familiar to network thinking and cultures, *Interference* is distributed heterogeneously. Launching the site turns out not to be a concurrent or similar viewing experience at all but a unique and solitary one. Only one person can gain access to the work at a time; should another participant try to engage, the script driving the page view launches "a placeholder page...and the viewer has to wait." [24] Each instance of *Interference* plays out uniquely as a kind of 'netfilm' for that participant alone. In a rather quiet and noninterventionist manner, Kargl tackles the diagram of the network in which ubiquity and homogeneity come to

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be the imperatives toward which its relations of force, hijacked by media and techniques of convergence, stratify into a diagram of network pattern, a network diagram. *Interference* instead makes us wait in line (an undecidedly non-networked experience), returning watching and interacting with the web to a myriad of singular, constitutive viewing instances. We are sifted back, systematically, into our inhomogeneities, producing a kind of emergent nonvisible yet singular networked audience. This kind of interference that refuses to hold itself to the increasing predominance of pattern formation – at its core an aesthetic-political diagram co-extensive with a society of control – touches upon a transversal interference:

> *Transversality..tends to be realized when maximum communication is brought about between different levels and above all in terms of different directions.* [25]

The ethical imperative for aesthetics that interferes with contemporary scientific imaging will be to 'lay down a path in walking' (as Francisco Varela once suggested) between and across the radical empirical possibilities of science's transmaterialism and an ongoing artistic commitment to what is indeed radical in the empirical. Heterogeneity. ■

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5. In *Into the Universe of Technical Images*, Flusser was already arguing in 1985 (the date of the book's original German publication) that we were inhabiting an informatic world comprised of photographic, televisual, cinematic and computational images. See Vilem Flusser, *Into the Universe of Technical Images*. For Flusser, then, the media support of the image is not what is at stake in understanding the cultural, aesthetic and social impact of images. Instead, what must be analysed and critiqued are the epistemological conditions under which images come to *ontologically* organise our broader ecologies of perception. The technical images that pervade contemporary culture, and of which the photograph was an initial instance, are a computationally produced mosaic of information compiled textually but without meaning. They alter our relation to the linear unfolding of meaning, previously generated by the sequential flows of information in text. Hence they change our relation to history and to previous dimensions of meaning-making such as linearity and the two-dimensional surface properties of representational images (like the painting or illustration).
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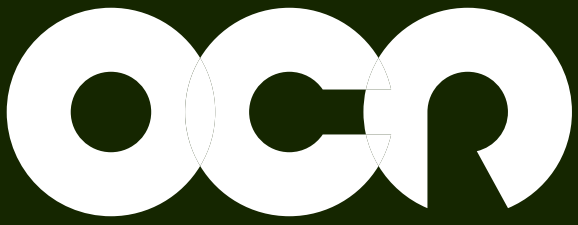

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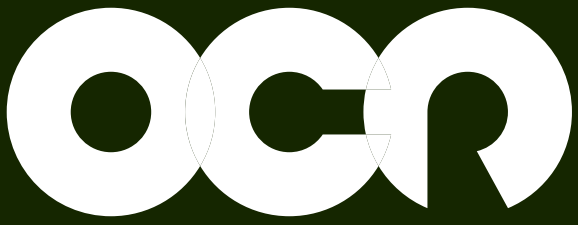

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