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The Grin of Schrödinger's Cat: *Quantum Photography and the Limits of Representation*

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'It's a poor sort of memory that only works backwards'

– Lewis Carroll, *Through the Looking Glass and What Alice Found There*

Introduction: Through the Rabbit Hole

DIGITAL-BORN PHOTOGRAPHY can be seen as both an indicator and a catalyst of a virtual and incorporeal visuality that constitutes an alternative to the perspectival, oculo-centric and linear visual schemas inherited from the renaissance.¹ This new visual regime disposes with the mono-centred grid of Brunelleschi's perspective in favour of a grid of fibre-optic cables, wi-fi transmitters, retina displays and electric power wires.² Visual culture has now entered a phase in which

computers and not humans are the ones who process, sort, store, archive and distribute images.³ When computers look at photographs they do not see aunt Helena, a sunset or a birthday cake with candles. Here a photograph is calculable information, not different from other bits of calculable information that we quaintly refer to as songs, films and books. In other words, digital-born photography is now part of the infectious, ubiquitous, seductive and addictive networked environment that underpins not only our interactions with computers but also the way individuals reach out to each-other via social networks, navigate through the city in a way that resembles surfing the web with a smartphone (from one wi-fi point to the next), decide where to go, what to consume and what to do by imperceptibly drawing from a layer of computational, algorithmic, remotely stored and processed information. The availability of this layer of screen-based information determines to large extent each individual's reach into the world and her/his ability to realise plans and projects.⁴

Out of Time

An image on a computer might look like a photograph and this resemblance can prompt discussions about the meaning of the image in the spirit of the Saussureian science of signs. However such semiological considerations are unhelpful as they usually lead to thinking about the image as signifier, coded message or representation and leave some questions unanswered – for instance: what can the digital image tell us about the network, and what is its relationship to time. It is perhaps more constructive to consider the digital image as a layer of ubiquitous information that continually combines and recombines figures, texts, glitches and numbers by passing electronic signals between the nodal points of the internet network; constructing cells, building new connections and creating proliferating, mimetic surfaces. The time of the digital image is not the linear, chronological time of the photographic archive, but something much more fractal, simultaneous and recursive.⁵ Multiplicity and instantaneity are now part of the digital image no less than the ability to order and demarcate historical time was part of the analogue photograph.⁶

Consider for instance that once uploaded to a computer and attached to the network, an image is not constrained to a single physical location but is able to move almost instantaneously from one place to another or appear simultaneously in several places at once. Within each contemporaneous context this blob of data forms a

temporary unity with other images, with varied and discontinuous experiential outcomes. Some instances of the image form “information spaces” that contribute to setting up narrative continuity.⁷ In some of these narrations the image might enter a sequence with other images and form a series, yet in other instances the image might fail to link-up or proceed to connect with an entirely different series. It is not only the case that photography is more-than-visual since becoming digital and networked, but also that the visuality of digital photography is augmented by the resonance of this instantaneous transformation – by the ability to affect and be affected, by the unpredictable diversity and simultaneity of the network. A digital image might be directly linked to a time and place in the past, or it can be synthetic, constructed within the bowels of the network purely through computation; but in any case it is also the product of the duplications, variations, transformations, and calculations which are part of the algorithmic and coded structure of the network.⁸ As digital images form series, continuities and assemblages they enter into relationships with other images, processes, machines and symbols, and in each instance material connections are formed that create concrete social realities. That the digital image is not meaningless is evident, but it is also evident that it cannot be “read” or “unpacked” with the tools of visual analysis because semiology and representation are unable to follow the narrative diversity in which meaningful sequences are not pre-given but develop out of logical statements, relational conditions, coded transformations and permutations that characterise encoded landscapes.⁹

Thinking Inside the Box

The world-view that asserted the superiority of the representational model persisted more or less unperturbed until the beginning of the 20th century, when this image of the universe was challenged, or rather demolished by the development of quantum theory. Suddenly the deterministic paradigm was flipped on its head; gone was the rational clock model, and the universe turned out to be unpredictable and chaotic, and every clock was to some extent a nebulous, indeterminate and amorphous cloud. This discovery was made by physicists studying electrons, photons and other quantum entities, but their findings had consequences that reached far beyond the sub-atomic level. As Heinz Pagels said in his book *The Cosmic Code*:

There is no meaning to the objective existence of an electron at some point in space, for example at one of the two holes, independent of actual observation. The electron seems to spring into existence as a real object only when we observe it[...] reality is in part created by the observer.¹⁰

For Vilém Flusser, the discovery of quantum physics meant that the old categories of matter and form were found wanting. Instead of the centralised logic of representation that emanates from the optical nerve towards the outer limits of space, he proposed to think of matter as made of layers, and not governed by a single set of laws:

“matter” now looks very much like a series of Russian dolls, one containing the others. The biggest doll is astronomical (Einsteinian), it contains the molecular doll (Newtonian), which contains the atomic doll (where mass and energy merge), which again contains the nuclear doll (where causality abdicates in favour of statistics), which again contains the particle doll (which poses curious problems of symmetry) and the smallest doll is the quark doll (where it is difficult, even meaningless, to distinguish between phenomenon and mathematical symbol).¹¹

For the physicist Erwin Schrödinger, the repercussions of quantum physics were so shocking that he devised the thought experiment that became known as “Schrödinger’s cat”. Nowhere is the strangeness and outwordliness of quantum physics better demonstrated than in the famous exercise that involves a certain cat, a deadly device that can be triggered by a single particle, and a particle generator. What is even more remarkable is that this experiment captures something of the innate ambiguity of the photographic image as it travels between the layers of matter. This is because Schrödinger’s cat suggests a new regime of the image, one in which the image is not a placeholder for a linear narrative but the visual manifestation of the difference between narratives.

The experiment places a cat inside a sealed room, isolated from all possibility of outside interference. Inside the room there is a light source that emits a single photon which passes through a half-silvered mirror. When the photon hits the mirror its reflection is split into two. The photon has a 50% chance of going through the mirror and hitting the wall and a 50% chance of being reflected down onto the light sensitive cell. Under normal circumstances, if the photo-cell registers a

beam of light it records it as an image, however in this experiment the wave-function of the photon triggers the photo-cell to smash a phial of cyanide which kills the cat.¹² If on the other hand the photon passes through the mirror without being reflected, then the photo-cell does not register an exposure and the cat is saved.

Now, for someone who is witnessing the event from inside the sealed room, (presumably wearing full protective gear against the deadly cyanide fumes), once the photon is fired the cat will be either dead or alive as we would expect. However – and this is the crux of the experiment – for an observer who is outside the room, the position of the photon is undetermined and consequentially the cat is both dead and alive at the same time. According to classical quantum physics (the so-called Copenhagen interpretation), when the particle is not being observed it does not behave like a particle at all but like a mixture of waves which represent the various probabilities of finding the particle somewhere within the box.¹³ However, when an observer is making a measurement, the act of measuring itself forces the quantum entity to choose one or another of these states. The curious and disturbing conclusion is that for each of the observers the factual reality of the experiment is different: for the observer inside the box the cat is either dead or alive, which is consistent with our existential experience of the world, but for the observer outside the box the indeterminacy of the unobserved particle forces the cat to be both dead and alive at the same time. The consequences of this insight could not be greater, for they not only mean that the laws of Newtonian physics do not apply to quantum particles, but they also suggest that the rational logic of traditional physics and mathematics cannot account for the events taking place within the dark chamber of the cat experiment.

Recall that the whole Newtonian-Cartesian framework was premised on the idea that reality can be accurately represented either mathematically with the aid of formulas or visually with the aid of perspective. In either case, to be known scientifically or experienced aesthetically a thing must be other than the knower because a thing is only known as a representation.¹⁴ However, Schrödinger's cat points to the collapse of representation as the idea that knowledge is external to the subject and can be objectively represented.

This is because the bifurcation of the real into two separate realities cannot be represented, or in the words of Deleuze '[t]he diversity of narrations cannot be explained by the avatars of the signifier, by the states of linguistic structure which is assumed to

underline images in general'.¹⁵ Because for each of the observers reality is different, no unified representation of it is possible. Instead, difference and not representation is the underpinning principle that holds the two observers together while simultaneously making them irreconcilable with each other.

Schrödinger devised the cat experiment to demonstrate the absurdity of applying quantum logic to something as big and complex as a cat, but the result was just the opposite. According to Newtonian laws of motion, not to mention standard logical reasoning, an object cannot be in two places at once. And yet, Schrödinger's cat stubbornly insists on being both alive and dead at the same time, inhabiting what became known as a state of indeterminacy.¹⁶

Before letting go of the cat, let me spell out the significance of the feline to photography. The photographic aspect of this experiment is not only in exposure of the light-sensitive cell to a particle of light but also – and critically – in the requirement for isolation between the room with the cat and the observer outside the room. This rupture exposes the divide between the moment of inscription by light that is taking place within the camera and the moment of “developing” that is taking place when a measurement is being made. In this rupture the ontological condition of the photographic image is revealed as the difference between two incommensurable states. The principle of photography is not in the indexical connection between past and present, nor is it the representation of abstract forms, but in the visual presentation of time as internally divided. The requirement for rupture institutes the possibility of an image that captures indeterminacy and a-symmetry as the very condition of visibility. The exposure produced by firing a single particle captures the difference between the two observers. It is neither the dead cat nor the alive one that constitutes the image, rather, the photographic element of the experiment is the very possibility of the co-existence of the two and the figuration of the difference between them. In other words, difference is expressed through the heterogeneity of narrations underpinned by the bifurcation of time. This bifurcation constitutes the materiality of the photographic image while at the same time asserting its indeterminacy.¹⁷ As the digital image on the computer screen is a configuration of particles that were clumped together by a computational process, it is significant that a quantum inspired understanding of photography suggests that apart from the forms of content such as perception, identity and representation, images are also forms of expression that contain open ended reflections

on the nature of computation, indeterminacy and the limits of representation.¹⁸

Getting slightly ahead of myself I want to signal that these understandings prefigure some of the conditions that describe the fate of the photographic image in digital culture. The condition of reproducibility does not warrant a connection with fixed reality. Instead, each repetition of the image opens up the possibility of indeterminacy, variation and multiplication that can pull the image away from an indexical connection with the past. Within the network the image operates on several levels – computational, electro-magnetic, economic, conceptual, particle – and each level produces separate but interconnected affects. The inherent instability of this assemblage makes it impossible to fix the meaning of the image and limit it to the content available to the gaze. Instead, significance and agency are formed by the relations, interactions and dialogues between the different parts of the system. In other words, meaning is established not through the procedure of representation but according to the manifold of relations to the other parts of the network.¹⁹

Plastic Control

Radical and liberating as quantum indeterminism was, with all the ensuing multiplicities of time and the polyphony of voices on offer, and notwithstanding the energising effect indeterminism had on art and literature, there was still a problem with this world view, which, to put it quite simply, threatened to undermine the whole project of converting all the clocks into clouds. This problem can be summed up as follows: the indeterminism model was at its core a theory that asserted that everything is governed by chance and nothing else. It suggested that the strict rules of the Newtonian clock universe be replaced by randomness, chaos and irresponsibility. In an article titled 'On Clouds and Clocks' Karl Popper sums this up nicely:

If determinism is true, then the whole world is a perfectly running flawless clock, including all clouds, all organisms, all animals, and all men. If, on the other hand, Peirce's or Heisenberg's or some other form of indeterminism is true, then sheer chance plays a major role in our physical world. But is chance really more satisfactory than determinism?²⁰

If everything in life is decided with the throw of a metaphysical dice, what hope is there to build a free and just society? Quite clearly, none whatsoever. If the determinism of the swinging pendulum seemed oppressive and inescapable, then how much more inescapable and how infinitely more oppressive is the thought that we are thrown into an abyss with no logic, no rules and no hope of getting out. This is the kind of desperate abyss that lead the exasperated Dostoyevsky to proclaim in *Brothers Karamazov*: ‘If there is no god then everything is permitted!’ It appeared that the discoveries of quantum physics, combined with Einstein’s theory of relativity threatened to do more than to simply overturn the old rational paradigm: in addition to heralding the age of nuclear power and super-computing it also seemed likely to unleash a form of radical nihilism that would jeopardise the very idea of freedom, choice and responsibility and replace them with an entropic mayhem were everything is down to accident.²¹

For Popper the dangers of this kind of nihilism were too grave to ignore. For one thing, this free-for-all indeterminism was only a step away from a fascist state, where no ethical or moral rules apply and everything is determined by pure force. If nihilism is the only certainty, how do you maintain some form of control over the rampant and unrestrained urges that are sure to raise their ugly heads? And to complicate matters further, how do you keep behaviour in check without appealing to the higher power of god, the absolute, or the torture chambers of the secret police?

Popper’s solution to this double headed problem of chaos versus determinism was simple and brilliant, and he named it “plastic control”. It was simple because he placed a middle point, a kind of halfway-house between the predictability of the determinist clock and indeterminism of the cloud. In positing plastic control as an intermediate membrane or a semi-conductor between determinism and chaos, between the world of representations and the world of probabilities, Popper sidestepped the dualism that maintained that things can only be one way or the other: either a cloud or a clock, either mind or body, image or object. Even more astonishingly, Popper suggested that this layer of plastic tissue is not another system, not a cloudy clock or a clockwork cloud, rather it is the site of consciousness, feelings, desires and sensations. In Popper’s own words:

we want to understand how such non-physical things as purposes, deliberations, plans, decisions, theories, intentions,

and values, can play a part in bringing about physical changes in the physical world.²²

Plastic control is therefore a cluster of appetites, affects and passions that brings together the physical and the analytical, combining them into something both carnal and controlling, both sensual and cerebral. In other words, Popper uncovered a synthetic diagram of social, political, erotic and physical drives that forms images out of chaos. Plastic control does not discipline chaos, but allows it to create connections between bits of matter and bits of ideas that do not fit with each-other like pieces of a jigsaw puzzle and yet they form something like a constellation or an archipelago, or a network.²³

According to the logic of plastic control, meaning is not to be located in the deterministic world of the clocks but equally neither is it in the indeterminate world of the clouds. As the grey area where feelings, desires, and games of chance rule over logic and reason, plastic control offers a glimpse into non-binary thinking that rejects the dualisms of form and content.²⁴ In the world of the computer networks, plastic controls are the algorithms that translate the social world of human activity into something that computers can understand as data. And conversely, plastic controls take computer data and make it into something that looks like a photograph when it appears on a screen.

Plastic control allows one to step away from the dialectical reasoning that conceives photography in terms of presence and absence, practice and theory, subject and object. It also exposes the fallacy of thinking about digital photography as being somehow immaterial or virtual. Digital images can be made without a camera, without chemistry, without lenses, even without light, which means that all the old rhetoric about photography being the trace of the real, or having an indexical connection to events in the past does not have to apply to the digital-born image. The idea that photographs have a representational, indexical or signifying connection with events, people and objects in the real world does not need to hold for digital images that rely on electronic signal and computation. The destabilisation of photographic meaning is the direct result of the image being detached from universal notions of representation and re-staged in terms of the plastic materiality that figures the image through difference, bifurcation and self-replication.

This understanding of the digital image as unchained from the dualisms of Western metaphysical thought can help to advance a

way of thinking that is taking on board the material conditions of the network. However, this insight requires the overcoming of the tendency of idealist aesthetics to think of photography as a process that mediates the world with the agency of light to produce legible signs. As the Schrödinger's Cat experiment suggests, the processes that govern particle distribution call for a different distinction between materiality and form. As there is no unified visual field the narrative is in every case irreducibly different. A further consequence to the overcoming of aesthetic representational thought is that the digital image does not have to be understood in visual terms as something to be looked at. Rather the digital image both undermines and transcends representation by actualising an interval between itself and its object. Through its diversity of narrations the digital image acts as a reminder that only the identical, the normative and the similar can be captured by representation while the expressive, the singular and the non-identical remains outside its reach.

It is however salutary to remember that representation operates in two distinct but interconnected ways: as a kind of epistemological code that organises information by creating order out of chaos, and as a political system that organises communities by instituting a shared ethical code. The principle common to all regimes of representation is the exclusion of everything that is singular and non-identical: the barbarian, the freak, the abnormal and the different need not apply. One does not have to be a unicorn or a little green man to be subjected to the exclusion principle: it is sometimes enough to speak with a slight accent, to stutter, to have a lame foot or anarchist tendencies. For this reason, the question for post-liberal political thought is how to inaugurate a community that does not depend on the codes of representation; how to remain sceptical and suspicious about the tendency of images and languages to privilege identity and cohesion over the clamour of disparate voices. Deleuze and Guattari name this non-representational community the nomadic war machine. Its primary objective is not war against the state but resistance to the forms of iconology of the state:

The war machine is that nomad invention that in fact has war not as its primary object but as its second-order, supplementary or synthetic objective, in the sense that it is determined in such a way as to destroy the State-form and city-form with which it collides.²⁵

This dimension of the war machine cements its relevance to the concept of the digital image: the modern capitalist state is marked by the systematic codification of life along the axes of technicity and representation²⁶ so as to eliminate libidinal creativity that constitutes the only possibility of resistance to empirical reality.²⁷

The digital image allows for the non-visual within the visual to become manifest as a diagram of the diversity of fragments. The digital image belongs simultaneously to two regimes of the visual: it is the annunciation of difference as the condition of visibility and it is a computational fractal that has no depth, no inside and no outside. Thanks to this “double articulation” the digital image is both a figure of identity and a figure of transformation of identity into new and unpredictable states. Variation and unpredictability are of another order than representation. They cannot themselves become a subject of representation or be reduced to it. What the digital image is capable of is to express the irreducible schism between the computational and the representational, not dialectically as “lack” or “absence” or “the excluded middle”, but as something inhabited and yet non-representational, like the grin of Schrödinger’s cat.

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Notes

¹ Central to the representational model is the glass-cut distinction between that which the eye can see and that which the mind can comprehend. Descartes famously demonstrated how unreliable vision is by comparing seeing to the actions of a blind man who tries to identify objects by tapping on them with a stick. René Descartes, *Philosophical Writings*, trans. Elizabeth Anscombe and Peter T. Geach (Great Britain: Thomas Nelson and Sons Limited, 1970), 248-9. He argued that the mind, on the other hand, is capable of seeing the truth thanks to the power of reason, which converts the distorted picture painted by the senses into true knowledge. In this way the mind became the true organ of seeing, and the eye (and with it the rest of the body) assumed the role of unreliable witness. This imagistic and pictorial model of the world achieved its most complete development in Kant's *Critique of Pure Reason*: 'Our representation of things as they are given to us does not conform to them as things in themselves, but, on the contrary, that these objects as appearances conform to our mode of representation.' Immanuel Kant, *Critique of Pure Reason*, trans. F Max Müller and Marcus Weigelt (London & New York: Penguin, 2007), 20 Bxx, xxi. Simply stated, this means that I experience the world as a unified time-space continuum not because that is what the world really is but because I experience myself as a unified entity. See also: David Summers, 'Representation', in *Critical Terms for Art History*, ed. Robert Nelson and Richard Shiff (Chicago: University of Chicago Press, 1996), 3-17.

² Joseph Nechvatal, *Towards An Immersive Intelligence: Essays on the Work of Art in the Age of Computer Technology and Virtual Reality* 1993-2006 (New York: Edgewise Press, 2009), 9.

³ For a discussion of a photographic system that does not involve visual presentation but is managed entirely by computers see: John Tagg, 'Mindless Photography', in *Photography; Theoretical Snapshots*, ed. Edward Welch et al. (London: Routledge, 2009), 20-21.

⁴ Nigel Thrift, *Non-representational Theory: Space, Politics, Affect* (Abingdon, Oxon: Routledge, 2008), 1-27.

⁵ Johnny Golding, 'The Assassination of Time: (or the Birth of Zeta-physics)', in *Writing History/Deleuzian Events*, ed. Hanjo Berressem and Leyla Haferkamp (Köln: DAAD, 2009), 132-145.

⁶ On demarcation of time see: Peter Wollen, cited in David Green and Joanna Lowry, *Stillness and Time; Photography and the Moving Image* (Brighton: Photoworks / Photoforum, 2006), 17.

⁷ "Information space", as a space structured through the flow of information, is drawing on the concept of "timed space", as developed by Parkes and Thrift. See: Don Parkes and Nigel Thrift, 'Putting Time in Its Place', in *Making Sense of Time*, ed. Tommy Carlstein (New York: J. Wiley, 1978), 119-129.

⁸ On the agency of code and its inherent undecidability (and how this undecidability is politically manipulated) see: Lucas Introna, 'The Enframing of Code', *Theory, Culture & Society* 28, no. 6 (2011), 113-141. On algorithmic photography see: Daniel Rubinstein and Katrina Sluis, 'The Digital Image in Photographic Culture; Algorithmic Photography and the Crisis of Representation', in Martin Lister (ed), *The Photographic Image in Digital Culture*, 2nd Edition (London: Routledge, 2013).

⁹ Introna, 'The Enframing of Code'. Also see: Gilles Deleuze, *Cinema 2: The Time-Image*, trans. Hugh Tomlinson and Robert Galeta (London: Athlone Press, 1989), 22-40.

¹⁰ Heinz Pagels, quoted in John R. Gribbin, *In Search of the Multiverse: Parallel Worlds, Hidden Dimensions, and the Ultimate Quest for the Frontiers of Reality* (Hoboken, NJ: John Wiley & Sons, 2010), 20.

¹¹ Vilém Flusser, 'Immaterialism', *Philosophy of Photography* 2, no. 2 (2012): 219-225.

¹² Roger Penrose, *The Emperor's New Mind: Concerning Computers, Minds, and the Laws of Physics* (Oxford: Oxford University Press, 1999), 375-6. See also: John Gribbin, *In Search of the Multiverse*, 170-2.

¹³ Penrose, *The Emperor's New Mind*, 375-6.

¹⁴ Claire Colebrook, *Ethics and Representation: From Kant to Post-structuralism* (Edinburgh: Edinburgh University Press, 1999), 2.

¹⁵ Deleuze, *Cinema 2*, 137.

¹⁶ Adrian Parr, *The Deleuze Dictionary* (Edinburgh University Press, 2005), 60.

¹⁷ Dorothea Olkowski, 'Time Lost, Instaneity and the Image', *Parallax* 9, no. 1 (2003), 28-38.

¹⁸ Flusser, 'Immaterialism', 218-9. This is not to suggest that photography became undecidable only since becoming digital. On the contrary, one of the most overlooked and under-theorised aspects of analogue photography is the so called "latent image": the invisible formation of silver halides produced by the exposure of light-sensitive emulsion to light. The latent image is not only indeterminate but also enigmatic, for until it is chemically developed there is no way of finding out what the image contains, yet development also destroys the latent image, effectively severing the connection between the image and the object.

¹⁹ Brian Massumi, *A User's Guide to Capitalism and Schizophrenia: Deviations From Deleuze and Guattari* (Cambridge, MA: MIT Press, 1992), 19.

²⁰ Karl R. Popper, *Objective Knowledge: An Evolutionary Approach* (Oxford: Clarendon Press, 1992), 226.

²¹ 'The underlying idea is that our body is a kind of machine which can be regulated by a lever or switch from one or more central control points. Descartes even went so far as to locate the control point precisely: it is in the pineal gland, he said, that mind acts upon the body. Some quantum theorists suggested (and Compton very tentatively accepted the suggestion) that our minds work upon our bodies by influencing or selecting some quantum jumps.' *Ibid.*, 232-233.

²² *Ibid.*, 229.

²³ 'Concepts are events, but the plane is the horizon of events, the reservoir or reserve of purely conceptual events [...] The plane is like a desert that concepts populate without dividing up. The only regions of the plane are concepts themselves, but the plane is all that holds them together.' Gilles Deleuze and Felix Guattari, *What Is Philosophy?* Trans. Hugh Tomlinson and Graham Burchill (London, New York: Verso, 1994), 35-36.

²⁴ This understanding of "plastic control" is inspired by Johnny Golding, 'Ana-materialism and the Pineal Eye: Becoming Mouth-breast (or Visual Arts After Descartes, Bataille, Butler, Deleuze and Synthia with An 's')'. *Philosophy of Photography* 3, no. 1 (2012), 99-121.

²⁵ Gilles Deleuze and Felix Guattari, *A Thousand Plateaus*, trans. Brian Massumi (London: Continuum, 2003), 418.

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²⁶. 'Technicity refers to the extent to which technologies mediate, supplement, and augment collective life; the unfolding or evolutive power of technologies to make things happen in conjunction with people'. Rob Kitchin and Martin Dodge, *Code/space: Software and Everyday Life* (The MIT Press, 2011), 42.

²⁷. Theodor Adorno, *Aesthetic Theory*, ed. Rolf Tiedemann and Gretel Adorno, trans. Robert Kentor-Hullot (London: Continuum, 1997), 86.