3.1 Graphesis and Code

The original title of this paper, "Digital Ontologies: The Ideality of Form in/and Code Storage—or—Can Graphesis Challenge Mathesis?," compressed considerable theoretical bulk into its boxcar phraseology.[1] Coming to terms with the basic idea of mathesis was an important phase in the development of my critical thinking about how the cultural authority of digital media is premised and how it might be challenged. So revisiting these matters is useful, even if the late-1990s debates about truth in photographic imagery that arose from digital works have subsided.[2]

The attempt to understand the connections that link human thought to its representation (in language, image or signs) has been central to Western philosophy of knowledge. In every generation, some version of this question has been posed: If it were possible to understand the logic of human thought, would there be a perfect representation of it in some unambiguous, diagrammatic symbol set? This question, informed by classical metaphysics and philosophy, persists not only in contemporary struggles within the very different domains of visual art, information design, and computer graphics, but also in early formulations of cognitive sci-

ence, with its proximity to symbolic logic, and in debates over artificial intelligence.[3]

Because of the emphasis on a distinction between idea and matter or form and expression that pervades Western metaphysics, the question arises whether an idea can exist outside of material form and yet appear to human perception.[4] Many forms and ideas are grasped by the human mind and communicable to a community of persons even though they exist without material instantiation—abstract concepts of law, love, justice, or spirit, for instance, or more concrete-seeming notions within the language of geometry, art, or social behavior ("good form"). But does this question take on a new cast when posed with respect to the digital environment? Should our conception of an image be changed by its capacity to be stored as digital code?[5] Or does code storage, as the defining condition of digital processing, finally satisfy the Western philosophical quest for mathesis, eliminating once and for all any ambiguity between knowledge and its representation? The various misperceptions of digital media as lacking materiality gain some of their credibility through connection to a tradition that idealizes the immaterial, even placing it in a theological frame, above embodied knowledge.[6] The argument that code is *material*, however, seems incontrovertible.[7] Digital code may be relatively unstable with regard to the bond between inscription and configured form (by contrast to a letter carved in stone, for instance), but the pattern of stored values on a silicon chip is ineluctably physical.

The argument can be made that computational media are overwhelmingly material—requiring rather large amounts of hardware to perform what was formerly done in rather minimal means (paper and pencil). But the perverse magnetism that draws concepts of immateriality toward the lodestone of code is provided by the curious belief (even desire to imagine) that perhaps, just perhaps, the configured form of code and the formal logic of configured thought might be analogous. At the very least, they might be made to conform to similar *rules* of logic, to be governed by, if not precisely part of, the same order of things.

A framework for this discussion comes from two disparate positions within twentieth-century philosophy: Edmund Husserl's notion of the "ideality of form" and Theodor Adorno's problematizing of the notion of self-identity of form because of the social-political implications that derive from alignment within totalizing systems.[8]

These two positions are useful as a means to address the formalist assumptions underlying the authority of digital media as construed in the popular imagination. The premise on which this authority is sustained is

a mythic one, as I hope to demonstrate. By moving between Husserl's embrace of ideality and Adorno's critique of self-identity the link between the idea of "data" and the materiality of its existence in digital form can be interrogated critically. This link is often overlooked in the rhetoric of cybermedia, and data is commonly presumed to be value-neutral, pure or raw, and immaterial. This allows data-as-code to be misconceived as exemplifying self-identicality—the relation of information to itself. If code and data configure each other in a perfect, isomorphic relation, and if that relation is abstracted into "ideality" instead of rooted in "materiality," the argument goes, then data and code are one and the same. Adorno would be quick to warn us that such yearnings for ideality preclude the critical reception of material expressions within cultural frameworks, where they operate in more pedestrian guise, rather like gods in mortal form in Greek mythology.[9]

My concept of "ideality" is derived from Husserl's discussion of the origin of geometry. The original geometer, he suggests, was able to apprehend *form* intellectually, outside of material expression.[10] Mathematical forms, he goes on to say, become apparent to human sentience—but are not dependent upon it (by contrast, the "form" of the story of Emma Bovary is dependent on human authorship even if it can live as a construct outside of the text). Husserl even suggests that the peculiar specificity of geometric forms is that, although they become conventionalized within representational systems, the original condition of their existence is independent of human constructs. Because mathematical forms have a claim to objective, universal status, even if their authority varies in cultural circumstances, Husserl's decision to focus on geometry makes his discussion appropriate to current mythologies in which the cultural authority of mathesis is supported.

If, following Husserl, geometric forms exist independent of human perception and are not changed by that perception from their ideal form, then does that ideality necessarily fall into the category of "self-identity" or "unity" of form? The idea of self-identity is anathema to Adorno, who argues that when empirical or positivist logic invades culture to such an extent that representation appears to present a unitary truth, there can be little or no room for the critical agency essential to any political action.

These two positions provide the poles of reference on which I examine the premises by which mathesis functions in current conceptions of digital data. I suggest that there is an underlying, at times overt, ideological bias in the way the myth of digital code is conceived in the public imagi-

nation. Because mathematical forms of knowledge are presumed to lie outside of ideology, this conception validates digital representation in a way that forecloses interrogation. My double agenda is to disclose the ideological assumptions in the way the ontological identity of the digital image is posed and to suggest that graphesis (information embodied in material, and thus ambiguous, formats) can challenge mathesis. In other words, the instantiation of form in material can be usefully opposed to the concept of image/form and code storage as a unitary truth or, to use Husserl's term, "ideality." My argument bears on digital media in its basic operation and use, not merely in what it represents. I suggest that the possibility of critical cultural agency is linked to the assertion that the real materiality of code should replace the imagined ideality of code.

Digital photography presents a useful starting point. Many questions about the truth, fiction, or simulacral identity of digital imagery were prompted in the 1980s and early 1990s by its presumed distinction from traditional darkroom photography. Images by photographer and early adopter Peter Campus, for instance, provoked critical discussion around matters of ethics and illusion. Such work and its reception offers a useful comparison with the fictions produced by those early-twentieth-century adolescents, Frances Griffiths and her cousin Elise Wright.[11] The pair created paper cutouts of fairies, expertly photographed by them in a garden setting, that appeared sufficiently real to elicit great debates. *Alice and the Fairies* (1917) shows one of the girls in a garden setting, a "fairy" close at hand. In this image, deceit seems inconceivable, as much due to cultural expectations about the innocence of adolescent girls as to the plausibility of fairies' existence in English gardens. That it was a hoax is now readily obvious. That anyone believed in the image based on its use of photographic codes seems less credible. By contrast, Peter Campus's digitally manipulated *Wild Leaves* (1995) was more simulacral than fictional (its impact comes from the way a surface can create a reality effect, rather than from narrative credibility), but a mere half step separates the photographic antics of Griffiths and Wright from those of Campus.[12] Any number of critics have pointed out that there is much more continuity than discontinuity in the shift from darkroom to digital.[13] The notion of photographic truth based on a pure, unmediated representation of a "real" referent was illusory even before Griffiths and Wright's confabulations; multiple exposures, multiple negatives, and blatant reworkings of both plate and print were all tools of the photographer's trade almost from its origin in the early nineteenth century.

Critic Hubertus Amelunxen contrasts two types of mimesis, both defined by Plato: eikon/likeness and semblance/simulacrum.[14] The difference between these terms supports distinctions between features of the photographic imitation of light and the presentation of an image of life as truth. Likeness privileges the indexical traces of actual light and the codes of verisimilitude that dominate our ideas of what truth "looks like." But in a world of digital special effects, the ability to produce virtual and hallucinatory reality is continually evolving. Market forces and competition, as well as habits of viewing, all favor novelty and invention. The skills through which the entertainment industry successfully deceives (some) of the senses raise philosophically charged questions.[15] But my argument is focused on the simpler, more fundamental question of assumptions about the truth value assigned to digital images as code.

Unlike traditional photographic "truth," the truth of the digital image is not, I would argue, posed as an index to the instant of exposure or as encoding the experience of "natural" visual perception. The digital image, photographic or not, is removed from those mechanics of production in which the metaphysics of light is linked via a moment of revelation to reality. Nonetheless, the digital image is (popularly and fundamentally) conceived as another kind of truth, premised on a deep conviction about a rational link between mathematics and form that is supposed to be irrefutably present in digital code. This premise is the foundation of a digital ontology. It promotes the idea that mathematical code is self-identical, irrespective of its material embodiment. This is a potent myth.

For the sake of argument, I want to approach the representation of thought as form along another trajectory, in which truth and form are put into a relation of identity. In the first decade of the twentieth century, the psychic Annie Besant produced a series of drawings of "thought forms."[16] Though her work, conceived within a late-nineteenth-century sensibility that embraced telepathy, magnetism, and the role of the medium, has a distinct naïveté, it also has a striking purity because of her conviction that thought *is* form and thus be manifested directly in visual images. Unlike Husserl's first geometer, however, Besant suggests that the representation of thought must be situated within a human context to be intelligible. She classed her images through a typology of universals: radiating affection, animal, grasping affection, watchful anger, jealous anger. These categories are typical of her time, a legacy of a theory of types and forms combined with a vocabulary of late-nineteenth-century psychology.[17]

By virtue of their schematic abstraction, Besant's visual forms have a formal resonance with a number of early computer-generated graphics,

such as those produced by Jack P. Citron in the 1970s.[18] In their minimal, skeletal appearance, Citron's graphics have a pristine innocence. The mathematics and logic of thought that created both algorithms and their manifestations were conceived of as thought beyond the philosophical frame of human subjectivity. *Geometric Digital Graphic from a Curve,* for instance, might be said to stand in relation to the algorithm that preceded it as the Copy does to Idea (eidolon) in a Platonic scheme. The image might even be consigned to the more debased category of Phantasm, a copy of a copy. But such a hierarchy presumes that Idea (and, by extension, algorithm) has a stable, fixed existence. Is Besant's original "thought," which her "form" presumably expresses, also such an algorithm? Do these artists create forms whose graphic identity, because it presumes to manifest an ideal form, shares a common belief about ideality?

As a digitally produced and manipulated entity, Citron's algorithm is also stored in material—in silicon—through a sequence of instructions and address codes. But here is the crux of the matter: like the ideality of Husserl's geometric forms, these algorithms seem to be capable of appearing to sentience, of being apprehended, outside of a material form—as thought.

Curiously, Citron's work is thematically engaged with these questions as well. He made several works that use algorithms to express and then distort a form. The images trace a process of deformation from the mathematical ideal of a geometric form through its distortion—by manipulation of its stored formula or code. This was a common theme in works by "digital artists" in the early 1970s, almost as if the problems of form as mathematical ideal and form as instantiation were paradigmatic issues for computer graphics. George Nees's *Random Number Generator Causes Swaying* maps the distortion in a regular pattern caused by introducing a random element, and the Japanese CTG group's 1971 *Return to Square* is almost a poster image for the comfortable fit between the ideality of the square as order and the process of debasement by which it is transformed into a (material) image.[19] If we imagine that the algorithmic representation of the geometry is the pure code, the ideality, then the material graphic representation will always be cast as the degradation, affirming the Platonic hierarchy of Idea, Copy, and Phantasm.

This opposition of algorithm and graphic manifestation, or of geometric idea and encoded algorithmic equivalent, entails a fundamental flaw. And this flaw, bound to the myth of the "immateriality" of digital artifacts, informs all celebration of "codework" as autonomous and transcendent.[20] The manifestation into substance, the instantiation of form

into matter, is what allows some thing, any thing, to be available to sentience. Ideas are apprehended through expressions (the illusory transparency of language as a means of expression often renders this invisible in common perception). This is true for the ideal form of a square, as well as for the analytic visualizations made by scientists using computer-generated images. An image of a complex molecule, for instance, purportedly showing detail at the atomic level, may in fact be a visualization expressing a mathematical model. The presumed ideality of the molecular structure, here made apparent as an image, serves as a convenient fiction through which we can gain access to the mathematical "truth" of the image, or even of the model it expresses.

But a digital image of something that is fully simulacral, such as the hyperreal renderings common in early music videos (as an example, the monster from Peter Gabriel's video *Mindblender*), refutes any easy link between an ideal algorithm and visualized reality as a fundamental unity. The existence of the image depends on the display, the coming into matter in the form of pixels on a screen. If, in one instance, the graphic display is manipulated by an algorithm, then, in other instances, the display becomes the site for manipulation of the algorithm. After all, the image on the screen is not even identical to itself. Not only are no two pixels alike, but the material expression of any algorithm varies from screen to screen, from moment to moment, from viewer to viewer. Embodied materiality is always distinct from the code it expresses. Conditions of use and perception enter into the production of an image in a very real sense, since forms are neither immaterial nor transcendent.

This brings me to the heart of my argument. What are we to imagine constitutes the "information" invoked or suggested in any of these various expressions? The algorithm? An ideal form (geometric or not)? An imagined molecule modeled mathematically? A simulacral monster whose algorithmic reality, its code-based model or identity, follows from the manipulation of data as visualized on the screen? In the visual practice of information design, in which graphic artists create schematic versions of the history of philosophy using as motifs an imagined solar system, or map thermal conductivity with fine, schematic precision, the assumption is that the information precedes the representation, that the information is other than the image and can be revealed by it. But we see from these examples that form is constitutive of information, not its transparent presentation. And no constituted expression exists independent of the circumstances of its production and reception.

Perhaps the most compelling, chilling image that I have come across

in thinking about these issues is a computer-generated graphic by a very early experimenter in this field, artist-scientist Melvin Prueitt.[21] It is a nocturnal image of a field of snow, unbroken and undisturbed. To my mind this is a terrifying image of the ideal of digital purity, the pristine visual manifestation of code. Nothing human or circumstantial disturbs its form. But it certainly is not pure, any more than any other image output by a plotting pen, laser jet, or Giclée printer. Any act of production and inscription, the scribing of lines that create the specificity of an image, demonstrates that an expressed form is different from the underlying code. Whatever the "ideality" of code may be, even if it were available to sentience in some unmediated way, the encounter of expression and matter produces thought as form. Any interpretive act returns to this initial inscription through its own productive and generative process, reinscribing a work as product within a specific situation of viewing.

In a very real sense, code lurks behind Prueitt's image of snow. In saying "behind" I mean deliberately to invoke an ontological and chronological anteriority. But this code can't be conceived as "pure" in the sense of being independent from a material substrate or instantiation into material. Code is itself always embodied, instantiated in material.

The digital encoding of form as information, as data, as patterns of binary code might be used to assert that our understanding of what a "form" is should shift toward the realm of mathesis. That tradition of logic, envisioned by Leibniz, still drives a quest for cognitive, epistemological, and technical certainty that seeks to reduce all formal, even material, expressions to a "higher" logical order of existence. But the ideality that Husserl envisioned for mathematical forms is generalized and reductive, a mere category and placeholder within human expression (even if assumed to exist in some ontological sense outside cognition). His geometries are not replete and specific forms capable of showing that the world is understood through experience and perception. Thus, we can define graphesis as knowledge manifest in visual and graphic form, and insist that it is based on understanding of form as replete, instantiated, embodied, discrete, and particular.

In Karl Fredrich Schinkel's eighteenth-century, neoclassical rendering *The Invention of Drawing*, the act of form-giving is depicted within the tensions between the lived and the ideal. Schinkel's image inverts Pliny's tale of Dibutades, in which the daughter of the potter traces the outline of her departed lover, changing the genders, so that female beauty is objectified as an ideal within a male gaze. This painting suggests that aesthetic form-giving is always an inadequate copy, a lesser truth than

the real. By contrast, in a late-1990s advertisement for Johnny Walker Red Scotch, a young man sits in khakis and topsiders on a deck, beachside, with his laptop computer open in front of him. On its screen is a wireframe graphic image of a dolphin, and beyond the man, leaping up and out of the Johnny Walker Red sea, we see the beast itself. The image of the dolphin on the screen does not match the image of the dolphin leaping from the ocean. Their direction, temporal moment, and other details are out of synch. But which is bringing the other into being? The visual image confuses the hierarchies of original and copy. The computer graphic seems to generate reality or, at the very least, to function on an equal, autonomous level as a form-producing environment. In *The Vision Machine*, Paul Virilio raises the specter of a sightless visuality, one in which images exist only as signals in the electronic currents of a closed system, readable by machines but neither visible nor legible to humans.[22] In such a situation, "form" is nothing other than code, still material but accessible only to some other sentience than the human. The case demonstrates even more fundamentally the link between the materiality of code storage and formal expression, since the networks cannot grasp ideality, only pulse and flow within their circuitry.

What is at stake in asserting the authority of graphesis—the material expression of form as the condition of its existence—is not the viability of code that has no graphic manifestation, but the fact that it is stored materially. Code is not an immaterial ideal. This in itself calls the mythic status of the digital as the realization of mathesis into question.

Such realizations have implications for the transformation of form from traditional media and representational systems into digital formats. They suggest that decisions about what aspects of material forms to encode, and how, have to engage with broader conceptions of information. When "form" is conceived in mathematical terms, it can be absorbed into an absolute unity of essence and representation. But when it is conceived in terms of graphesis, it resists this unity, in part through the specificity imparted by material embodiment.[23] Materiality cannot be fully absorbed into ideality, nor can it be understood as a mechanical, self-evident literal identity. Something is always lost when, for instance, a text is translated into ASCII format. Digital media have their own materiality (and material history to be sure), but in the distinction between mathesis and graphesis the resistance to the totalizing drive of the digital can be articulated. This is the beginning of the place from which an argument about the ideology of code can be created, but also the place from which a literal approach to materiality can be critiqued.

I return, for a final moment, to Melvin Prueitt's digital snow-field, in which, as Amelunxen says of such work, the gap between the algorithmic-numerical image and its origin is so slight that it seems to cast "no shadow." But the gap does exist. The distinction can be made just as surely as in any conceptual work. There is always a space between expressed idea and expression of an idea. The ideas that drive conceptual projects are not immaterial—they are usually expressed as language, as coded procedures capable of generating any number of material instantiations. But even as procedural statements, they are already both code and matter. Unless we revert to the mystical concept of ether, the base materiality of all human expressions will need to be accounted for in any analysis of objects and artifacts, forms and ideas, that are part of human experience.

Thus the crisis introduced into aesthetic discussions by digital media is not, as commonly reported, a crisis of the copy, of originality, or of authenticity or truth. What is at stake is more poignant, since it depends upon the possibility of reinscribing form into matter as part of a human, cultural, and social system. If code is ideal form, it resists inflection, cannot register subjectivity in its production or interpretation. But the specific, particular character of materiality always registers the circumstances of production, expression, interpretation.

This argument against the immateriality of code fosters critical consideration of the ways it actually participates in and helps replicate cultural mythologies. It dispels the idea of code as either self-identical or transcendent, or as constituting a truth. The easy interchange of image into code and back into image becomes loaded with a myth of technosuperiority, as if the independence of code from matter were so fundamental it could never questioned. In a system premised on mathesis, code is presumed self-identical, unavailable to critical interrogation, and everything else is reduced to data and equivalents. When this claim is extended to the cultural realm of representation, its hubris needs to be challenged. Graphesis is always premised on the distinction between the form of information and information as form-in-material. It insists on recognition of the specificity and particularity that resists self-identicality.

Most important, this argument cannot be reduced to a distinction between digital and analog. Whether an artifact exists as print, code, digital file, or physical image, its material expressions are always undergoing changes, aging, crumbling, acquiring or resisting wear. All forms of expression are ontologically incapable of self-identicality. Graphesis is premised on the irreducibility of material to code as a system of ex-change and equivalents without acknowledgment of its specific instantiation. The materiality of graphesis constitutes a system in which there is loss and gain in any transformation that occurs as a part of the processing of information. In that process, space to register subjective inflection creates a place within which Adorno's critical reason can operate and in which humanity, such as it is, can be expressed. Digital media are no different than traditional media in this regard, but the claims and mythologies they sustain have allowed aesthetic work to be used to justify a cultural authority in which logic and its formalisms trump other, experiential, forms of knowledge. Or try to. Digital media are not Prueitt's dead zone of insubstantial rendering, in which neither experience nor perception, human subjectivity nor or social experience register. This realization presents a far more optimistic outlook than if the code world were a realm of intangible remoteness, absolute and transcendent.

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1. This piece took many forms: "Digital Ontologies: The Ideality of Form" (Digital Arts Conference, 1999), "Ontology of the Digital Image" (Wesleyan University, 1997), "Theoretical Informational Aesthetics" (Cal Arts, 1998), and various versions of "Code Storage" (keynote, Mixed Messages Conference, University of North Carolina, 1997; New York University, 1998). It was first published as "Digital Ontologies," *Leonardo* 34, no. 2 (2001): 141–45.

2. Martin Lister, ed., *The Photographic Image in Digital Culture* (London: Routledge, 1995). H. Amelunxen, S. Iglhaut, and F. Rötzer, eds., in collaboration with A. Cassel and N. G. Schneider, *Photography after Photography* (Basel, Switzerland: G&B Arts International, 1996); Mitchell, *Reconfigured Eye;* Druckrey, *Iterations;* Fred Ritchin, *In Our Own Image* (New York: Aperture, 1990).

3. Crevier, *AI.*

4. Jacques Derrida, *Edmund Husserl's Origin of Geometry: An Introduction,* trans. John P. Leavey Jr. (Lincoln: University of Nebraska Press, 1989).

5. Ritchin, *In Our Own Image;* Lister, *Photographic Image;* Mitchell, *Reconfigured Eye;* Kirschenbaum, *Mechanisms.*

6. See Amelunxen et al., *Photography after Photography,* for the specific characterization of the Platonic hierarchy relevant here.

7. Kirschenbaum, *Mechanisms.*

8. Peter Osborne, "Adorno and the Metaphysics of Modernism: The Problem of a Postmodern Art," 23–48, and Peter Dews, "Adorno, Poststructuralism, and the

Critique of Identity," 1–22, both in *The Problems of Modernity: Adorno and Benjamin*, ed. Andrew Benjamin (London: Routledge, 1989); H. Brunkhorst, "Irreconcilable Modernity: Adorno's Aesthetic Experimentalism and the Transgression Theorem," in *The Actuality of Adorno*, ed. M. Pensky (Albany: State Univ. of New York, 1997).

9. Brunkhorst, "Irreconcilable Modernity."

10. Derrida, *Husserl's Origin of Geometry*.

11. For a discussion of Griffiths and Wright, see *Faires: The Cottingley Photographs and their Sequel* (Theosophical Publishing House, 1966). On the ethics of digital manipulation, see http://www.astropix.com/HTML/J_DIGIT/ETHICS.HTM.

12. For Peter Campus images, see http://moma.org and http://www.gravus.net/

13. Lister, *Photographic Image*. Amelunxen et al., *Photography after Photography*.

14. Amelunxen et al., *Photography after Photography*.

15. For a useful resource on digital image manipulation, see http://www.media-awareness.ca/english/resources/educational/teachable_moments/photo_truth.cfm.

16. A. Besant and C. W. Leadbeater, *Thought Forms* (London: Theosophical Publishing Society, 1905).

17. I am thinking of the context in which Wilhelm Worringer's work was produced, for instance, or that of Wassily Kandinsky: that early twentieth-century investment in aesthetic systems of correspondence and universals that came out of late-nineteenth-century symbolism.

18. Herbert W. Franke, *Computer Graphics Computer Art* (New York: Phaidon, 1971).

19. Source for these is Jasia Reichart, *Cybernetic Sensibility* (New York: Praeger, 1968) and *The Computer in Art* (New York: Van Nostrand Reinhold; London: Studio Vista, 1971).

20. Alan Sondheim, *Disorders of the Real* (Barrytown, NY: Station Hill Press, 1988); Loss P. Glazier, *Digital Poetics: The Making of E-Poetries* (Tuscaloosa: University of Alabama Press, 2002); Brian Kim Stefans, *Fashionable Noise* (Berkeley, CA: Atelos, 2003). See online the previously cited Rita Raley references; Jim Rosenberg, essay (http://www.well.com/user/jer/NNHI.html) and poetry (http://www.eastgate.com/people/Rosenberg.html); John Cayley (http://homepage.mac.com/shadoof/net/in/inhome.html); and Jim Andrews, "Vispo, Langu(im)age" (http://www.vispo.com).

21. Prueitt, *Art and the Computer*.

22. Paul Virilio, *The Vision Machine* (Cambridge: MIT Press, 1995).

23. Kirschenbaum, *Mechanisms*, makes this point more strongly and clearly as the basis of a definition of forensic materiality. See chapter 1, "Every Contact Leaves a Trace."