Making mathematics public: Aesthetics as the distribution of the sensible

Elizabeth de Freitas
Adelphi University

"First one hundred of ten thousand five inch lines within an area of 6 ¾ x 5 ½ inches: A tribute to Sol LeWitt wall drawings"
Photo credit – Tamir Klinger

Introduction

The density of ten thousand lines in such a small patch seems formidable; the obsessive repetition of such a precise act—a line drawn five inches long—seems peculiar, even
absurd. Who and why would anyone submit themselves to such an arcane act of inscription? And how is one to make sense of this as art? Like much conceptual art, the wall drawings by Sol LeWitt demand that the viewer revise their expectations for something traditionally beautiful and possibly even abandon their assumptions about aesthetics and art. LeWitt’s work from the 60’s and 70’s was a radical rethinking of aesthetics and art, an attempt to make art more public and to reclaim aesthetics from the mystical realm of abstract intuition and inner private feeling.

In this paper I explore LeWitt’s wall drawings as a means of rethinking aesthetics in relation to mathematics. I propose the analogy that mathematics is another kind of wall drawing insofar as it is a form of “doing and making” that involves semiotic inscription and image making, a kind of obsessive scratching on various two dimensional surfaces, and thereby, an activity that is oddly akin to the drawing above. The analogy is meant to be multi-faceted, drawing our attention to the absurd nature of mathematics, while also directing our attention to the role of surfaces in the doing of mathematics, and the way that subject positions are constituted in relation to these surfaces. This paper is thus a study of the ‘written-ness’ of mathematics, an examination of its status as a semiotic activity bound to the two-dimensional surface, and not a study of its verbal discursive construction, nor its cognitive acquisition. I use the term ‘written-ness’ to designate all forms of sign making that operate through surfaces, and thus I rely on the distinction between writing and speaking while at the same time tracing the way that this distinction implicitly validates a particular epistemological approach to making sense of mathematics. The paper focuses on the function of writing in mathematics (writing as the material act of sign making on the two-dimensional surface; writing as a tag for graphism), and how this activity is constitutive of the mathematical subject and simultaneously the community of practice. Writing, in this sense, is not the logical positivist’s dream of an ideal symbolic language, but rather a highly “sensible experience” (Radford, 2002, 15) that is inherently gestural and figurative. In this sense, I am using the term “writing” to designate actions that involve encounters with surfaces.

My point here is not to diminish the role of other kinds of semiotic activity in mathematics, but to explore writing as a material and sensual practice through which mathematical thinking emerges. In an important sense, this aim echoes that found in the work of David Pimm (2006), where he examines the “possible demarcations between image and word in relation to mathematics, as well as beliefs about the relative propriety of those things that can be shown and those that can be said” (161). This notion of “relative propriety” opens up questions about the epistemological ranking of various kinds of semiotic activity within mathematics. In this paper, I explore these questions by focusing on the neglected role of surfaces in doing mathematics. This is a speculative paper that dwells philosophically on the separation of writing from speech—and the role of surfaces in sustaining that separation—as a means of tapping into alternative visions of aesthetics and mathematics. I draw on the philosophy of Jacques Ranciere who advocates for a more political reading of aesthetics, whereby aesthetics is seen as inherently political and constitutive of community through the distribution of the sensible. I leverage this approach to aesthetics, and trace its possible applications to mathematics.

The distribution of the sensible

I call the distribution of the sensible the system of self-evident facts of sense perception that simultaneously discloses the existence of something in common and the delimitations
Researchers in mathematics education often bemoan the commonly perceived disjunction between the arts and mathematics, arguing that impoverished visions of mathematics, which deny the discipline any claim to creativity and emotion, must be revised so as to recognize the inherent aesthetic qualities of doing mathematics (Sinclair, Pimm & Higginson, 2006). Sinclair (2006) suggests that we “reclaim” aesthetics from the arts, and study how aesthetics functions within mathematics. In her argument, aesthetics is used to signify feeling, intuition, imagination, affect and perception—a set of descriptors traditionally opposed to the cold, hard, objective reasoning associated with mathematics. Drawing on Dewey, who argued that aesthetics is that which brings imagination and reason into agreement, Sinclair describes the aesthetic in mathematics as the feeling of “fitness” between cognitive powers, a feeling of mastery or success at having made something comprehensible (19). Similarly, Poincare’s concept of a “special aesthetic sensitivity” (cited in Sinclair, 2006) by which mathematicians develop a capacity or inclination towards “seeing” order and pattern is an attempt to break down the dysfunctional binary between art and reason, and reclaim the aesthetic as inherent to mathematics.

Despite the power and appeal of an argument in favor of recognizing the interwoven nature of reason, affect and imagination, these sorts of discussions are all too often couched in a cognitive framework whereby aesthetics is reclaimed as a legitimate form of reasoning, where reasoning remains at source a cognitive capacity or faculty, much akin to a Kantian apriori schema (Radford, 2005). Thus the ground gained by rejecting a cold analytical vision of mathematics is lost when the argument is based on the assumption that aesthetics and reasoning are internal pre-given structures or faculties impinging on experience (and cultivated through experience).

Although this particular theory of aesthetics resonates strongly with many mathematicians because of the way it validates the emotional and phenomenological aspects of doing mathematics, in this article I try to explore a more political theory of aesthetics, and hope to show how such a reading lends itself somewhat differently to the project of making sense of mathematics. This other theory of aesthetics is derived from the work of Jacques Ranciere whose attempts to “reclaim” aesthetics from the narrow confines of those who would see it as a pre-given cognitive response to experience has led him to explore aesthetics as a political practice.

For Ranciere (2004), aesthetic practices and political practices are fused precisely because together they partake in “the distribution of the sensible,” which discloses and determines that which is held in common within a community. Artistic practices are simply ways of “doing and making” amongst the many other ways of doing and making within a community, but they are uniquely generative of forms of visibility and sensibility and thereby central to the process of constituting and structuring legitimacy within the community (Ranciere, 2004). It is for this reason that new art forms or aesthetic practices are often resisted.

Ranciere argues that “the distribution of the sensible” is that which articulates the junctures between aesthetic and political practices. Accordingly, the distribution of positions from...
which one “experiences” spaces, moments and actions (in other words, the location within culture from which one engages the limits of the sensible) determines a regime of participation and exclusion. The ways in which we occupy these spaces and moments—the manner of our work or activity—constitutes our legitimacy as political beings. According to Ranciere, the arts act *doubly*: as forms of art *and* as forms that constitute community. The arts are central to defining and indeed constituting a “sensible positivity” (14), which is bound to particular historical contexts. Ranciere makes this argument by examining the history of art in the West, pointing to various examples of artistic developments that radically transformed the nature of subjectivity. He retraces the emergence of the novel and its reception as “democracy in literature” and the fusing of pure art with ornament in the development of decorative arts such as Art Deco, and how this new art form hailed a new sort of citizen for whom the pictorial surface was “a surface of shared writing” (15).

The important thing is that the question of the relationship between aesthetics and politics be raised at this level, the level of the sensible delimitation of what is common to the community, the forms of visibility and of its organization. (18)

I want to leverage this political vision of aesthetics, and ask how mathematics, as an aesthetic practice, functions at the level of delimiting the sensible and determining its organization. If, following Rotman (2000), we assume that doing mathematics is a semiotic practice, an artful drawing of silent inscriptions by which the two dimensional surface is marked by coded signifiers, pencil traces, symbols, lines and shapes, and that these acts of inscription are not the traces of some prior immaterial thought, but are indeed the material act of thinking itself, then how might this practice function in the partitioning of the real? What does it mean for mathematics to always involve this act of inscription on the two-dimensional surface? How does the writing of mathematics determine the contours of the sensible? How does this aesthetic act actually generate a political form of recognition that constitutes the limits of legitimate participation within a community? How does the denial of legitimacy to other forms of “making and doing” function to exclude others from the community? How might the aesthetics of mathematics be implicated in the constitution of what is considered a form of legitimate subjectivity? Might it be the case that the drawing and writing and inscribing of ‘abstract’ signs on a ‘flat’ surface (be it a computer screen or a static page or other more twisted surfaces) is both an aesthetic act and a political act, insofar as this kind of “doing” determines (and doesn’t just reflect) the limits of the sensible for our communities of practice? And if so, in Ranciere’s terms, how does this aesthetic act correlate to the mapping of particular “perceptual coordinates” in a community of practice? How does this act of writing in mathematics actually produce the limits of what is visible (and what is thereby endowed with a “common language” for those who are within that elite community of practice)?

All of these questions seem to point to the neglected role of surfaces—material borders between an inside and an outside—by which the sensible world is recognized, partitioned and encountered. The sensible world is a world of surfaces, a tangible world of skin, ground, wall, and screen. We tend to demote the surface as that which has no substance of its own; the notion of a surface seems to instantly summon up the specter of the other more full substance within or beyond. And yet Gould (1982) talks about the evolution of life in terms of the proliferation of surfaces, of increasing the folds of those surfaces (and eventually internalizing these surfaces) as complexity increases. Similarly, Deleuze (1988) talks about substance in terms of folds, twists and the “invagination of a tissue” (Deleuze, 1988, 98), and extends this discussion to the constitution of subjectivity (and the interiority
of the ‘self’) whereby the subject “emerges from a topological twist of the surface itself” (Žižek, 2005, 178). Indeed, the surfaces that seem to define an otherness of some kind (as that which, or whom, is outside) often suddenly reveal themselves as fungible and permeable, collapsing as we reach out to touch them, and thereby redefining the contours of subjectivity and otherness. Technological developments introduce new interfaces of all kinds and play with the surfaces that define the sensible; Microsoft’s “Touch Wall” and “Surface” are two of the more recent developments that explore the way new surfaces can transform gesture into a form of writing.

Surface has always been a central concept in the history of fine art. In painting, for instance, one can trace the development of naturalism or realism as a “recession” of surface insofar as the viewer is meant to “see through” the surface to the subject matter depicted (Robbins, 2002). A painter in this tradition would aim to make his brushstrokes invisible, so as to better conjure the depicted object. The surface is meant to function as a medium or platform for the painting, but its presence should be diminished as much as possible. In contrast, modernism’s rejection of naturalism or realism is an embrace of the materiality and impenetrability of surface. Modernist painters—from Picasso to Pollock—playfully celebrate the presence of the surface in radically new ways. Modernist painting is about the physicality and process and production of painting; it embraces the surface as the site of this physicality.

The surface of the artwork is a critical point, then, in modernist art, as painting moves away from the hegemony of illusion and perspective that dominated painting from the Renaissance into the modern period. In each of these historical moments, surface is central to the dominant ideology—on one hand, through its suppression, on the other, through its assertion. (Robbins, 2002)

In mathematics, we rarely talk about the surfaces upon which we so lovingly dwell. These material surfaces—paper or chalkboard or screen—implicitly partition the sensible world into domains of the here and the beyond, of the sensible and the non-sensible, of access and denial. The binary between the concrete and the abstract, for instance, is constituted in relation to a particular surface. It is the surfaces upon which we scribble and compose our mathematical thinking that delimit our conceptual structuring of the universe. When we ask: “where is the mathematics in this diagram?” — we are simultaneously naming the limits of the sensible (the question names the diagram as proto or pre-mathematical) while engendering another untouchable world beyond the surface, where the mathematics lies. But precisely “where” is the mathematics? What place does it occupy? The specialization built into our use of language betrays the significance of these surfaces in partitioning the real from an invented phantom immaterial or transcendental referent. Ranciere reminds us, what is visible (or sensible) constitutes our “common language,” and what is invisible (or transcendent) must be managed and accessed through political affiliation. As de Certeau (1984) suggests, “spatial practices in fact secretly structure the determining conditions of social life.” (96).

If the sensible world is a world of surfaces, and mathematics is a kind of “doing and making” in relation to those surfaces, then one can ask the question as to what extent these surfaces and this writing conditions and partially constitutes the subject position of the mathematics student.

Pimm (2006), focusing less on the surface and more on the inscription, suggests that the development and dominance of algebraic formalism in the nineteenth and early twentieth
century reflected a particular form of agency—“agency of the letter”—whereby the
diagram or image was demoted as an inferior form of mathematical graphism, while
algebra was seen as the central activity of “doing and making” mathematics. Despite the
emphasis on writing, Pimm argues that the development of algebraic formalism lead
ultimately to a vision of mathematical inscriptions as iconic references or “sign-posts” to
some other immaterial world beyond this one[1]. He identifies a correlation between this
algebraic formalism and a similar movement in art known as abstract expressionism—
painters such as de Kooning and Pollock—for whom art was an expression of inner
spontaneous feeling or intuition, and for whom the surface was the material site for
recording this expression. The correlation he draws between related movements in art and
mathematics sheds light on the related practices that determine legitimate participation
within and across each community.

I want to extend this attempt to think through aesthetic developments in both art and
mathematics by considering one of the art movements that followed abstract expressionism
—that being conceptual art—and to examine the ways in which Sol LeWitt, as
representative of that movement, further troubled our assumptions about graphism and
surface.

LeWitt Wall Drawings

The art is inscribed on white walls in a set of connected rooms and in the corner of a
corridor connecting two other corridors. As you approach, you notice that there is no
canvas, no frame, no base or pedestal. You notice that there is nothing to detach from the
wall. You see black pencil drawings drawn directly onto the walls. You walk into the
rooms, towards the walls, along the corridor. The wall drawings invite you to engage the
wall itself in different terms, in terms that trouble your tacit beliefs about surfaces and
boundaries. You glance at the entire height of the twenty-foot wall, overwhelmed by the
enormity of a repeated geometric pattern scaling the room. You move forward, nose to
wall, suddenly intimate with the surface bumps and abnormalities. You move yet closer, so
close now you can see the slight gradations of graphite that indicate a human hand held the
pencil and applied the pattern to the wall. You imagine your own hand tracing the lines—
some straight and some decidedly squiggly—with the sort of obsessive rigor required in the
creation of something so simple, so exhaustive, and so beautiful. You are tickled by the fact
that an eraser could so easily wreak havoc on this massive art installation. You enjoy the
impermanence of the pencil marks, the humility of both the wall and the two-dimensional
forms applied to it. You think of the hands that were enlisted to execute this pattern. You
revel in their imagined hand gestures, their commitment to each localized pencil mark, the
days and days of narrowed attention, while the two-dimensional structure grew and grew
and filled the room. You know the perverse pleasure of adamant rule following, of tapping
out all possible permutations and implications, of following a thought so completely that
you are taken into the absurd.

Since 1968, various Sol LeWitt wall drawings have been executed on walls all over the
world, in art galleries and elsewhere, by LeWitt and other artists. Each wall drawing comes
with a set of detailed instructions as to how the work is to be produced. When renting a
LeWitt wall drawing, one obtains these instructions and goes about executing them on a
wall. As a form of installation art, the wall drawings often require days to complete, and
are frequently installed on enormous walls and at unusual sites. The drawings are most
often comprised of straight lines, squiggles, geometric shapes and projections, and many of
them include, as part of the wall drawing, the written instructions to be followed in their construction. As a leading advocate of conceptual art, LeWitt wanted to demystify art by suggesting that any “draftsman” could execute his work, that it was not the artist’s “hand” that made the art, but rather the “idea” that made the art. Ironically, the wall drawings are incredibly sensual, as though the execution of the instructions overflows and undermines the rational manifesto of conceptual art.

A recent execution of a LeWitt wall drawing entitled “scribbles” at the art institute of Chicago in February 2008 by Takeshi Arita and Eileen Jeng was documented by video and can be seen at http://www.artic.edu/aic/visitor_info/podcasts/video/sol_lewitt.html. The artists explain that there is a great deal of judgment involved in the execution, that it is not a matter of copying the instructions, nor is it simply imitating a previous performance. Uniqueness is inevitable, despite the precise instructions. There is an inevitable inadequacy in the instructions, something that is true for all instructions, including those in first-order logic (the most precise language we know), which will always require the artist to introduce unique elements into the drawing.

The four days of placing “controlled scribbles” on the wall required excessive and obsessive and mind-numbing repetitive gestures as well as profound personal and subjective judgment as the artist executes the gesture and reflects on the instructions. Since the artwork is performed differently by different artists, the results are always slightly different. In each case, however, the piece is called a “LeWitt.” The ownership of the art is troubled by the fact that more than one can exist simultaneously in different galleries, and each can be somewhat different from the other, and yet they all have the same title attached to them. In this way, LeWitt’s work plays with notions of public art and uniqueness. He has demystified the artist and the making of art by detaching the artist’s hand from the execution of the art, and by inviting others to execute art in his name. “Ideas cannot be owned. They belong to whomever understands them.” (LeWitt quoted in Weber, 2000, 89).

LeWitt’s work was crucial in criticizing the cult of exclusivity surrounding authorial execution and “handmade” art. LeWitt’s invitation for others to execute his works, and the consequent public distribution of his art as a consequence made the point that “anyone with a pencil, a hand, and clear verbal directions” could execute his drawings (Richardson, 2000, 38). One is tempted to suggest that these wall drawings are a sort of artform that harkens back to Plato’s cave drawing, because of the reference to the singular “idea” that underwrites each execution. But that would be to miss the point of conceptual art altogether. LeWitt’s wall drawings contrast starkly with Plato’s cave drawings because LeWitt debunks the notion of an original source of signification, instead dispersing the authority of the artist and making transparent the procedure of the production of the ‘real.’ Unlike Platonic notions of an original source of signification, there is no idealism or epistemological hierarchy regarding the process of meaning making. In the art world where the value of a painting is determined by the “authenticity” of the hand that made it, LeWitt undermines the hierarchy of value determination. By continuing to have his name attached to each execution, he explicitly demands that the viewer question the valuing of authenticity in art.

LeWitt was influenced by Samuel Beckett, whose writing often employs an obsessive listing of possible permutations of a phrase, exploring variations in systematic and absurdly rational ways (New York Times, 2007). Beckett’s exploration of the inherently absurd nature of logic, language and life informed LeWitt’s development of his wall drawings. LeWitt claimed, “Irrational thoughts should be followed absolutely and logically” (LeWitt, 1969, 12). LeWitt’s attempt to perform the rational (and its irrational double) might be misinterpreted as being cold, analytical and cerebral. But his work, like that of Beckett,
often speaks more directly and nakedly of the material and human world than does abstract expressionism—the movement into which LeWitt arrived as an artist. Abstract expressionism, with its attempt to capture the feeling or emotion of an impression or object through colorful “abstract” unscripted or spontaneous painting was, in LeWitt and others views at the time, a mystification of the art making process.

Another obvious association is with that of the work of M.C. Escher, if for no other reason than LeWitt, like Escher, explored the ramifications of following and repeating and permuting patterns. Escher, however, falls squarely within the Op Art movement in which artists explored optical illusion and perceptual conundrums, while LeWitt was principally motivated by political and conceptual issues about the location of art in society. Notwithstanding this important difference, both artists explored the representation of geometric, and in some instances impossible, structures on two-dimensional surfaces, and both were interested in the relationship between the ‘picture plane’ and illusion.

LeWitt wall drawings were a means of focusing on or reinforcing the function of flatness, and many of the drawings play with perspective and the rules of representing three-dimensions on a two-dimensional surface. Each wall drawing comes with a set of instructions as to how to produce it, and these are meant to be as minimalist as possible and without metaphor. Consider the sequence of impersonal commands that accompany one piece:

A rectangle whose left and right sides are two thirds as long as its top and bottom sides and whose left side is located where a line drawn from a point halfway between the midpoint of the top side of the square and the upper left corner to a point halfway between a point halfway between the midpoint of the bottom side and the lower right corner and the midpoint of the left side. (LeWitt quoted in Lippard, 1978, 24)

Typical of written mathematics, the long descriptive sentence is dense with relational clauses that identify characteristics of the lines and points under construction, but is bereft of all other verbs and indicators of action. The instructions for production—the series of acts required to create the art—are linguistically realized in a paragraph that is more like a detailed description of the static image. All of the action has been written out of it. The grammar is unmistakably that of written mathematics, although muddied by some everyday language and deictics such as “left” and “right,” but this is necessary since LeWitt is interested in location and site specific acts of art making, and thus orientation in relation to the location is essential. LeWitt’s instructions mimic formal written mathematics with its excessive use of grammatical metaphor, but they retain a spatial sense of surface and location through being part of an installation. As such, the phrasing shares traits with verbal
mathematics because of its deictic references (Radford, 2002). Unlike written mathematics, the drawings (and their instructions) retain the “symbolic narrative” (Radford, 2002) that ties them to their material production.

The effect of these drawings is to highlight the material production of meaning; in many cases, the last part of the instruction is the command that the instructions themselves should be written into the drawing (along designated lines or in specified locations). This interplay between the grammatical forms found in written and spoken mathematics, and the tension between place and non-place found in LeWitt’s art, sheds light on the significance of the binary between speech and writing in relation to aesthetics.

**Unpacking the binary between speech (presence) and writing (deferral)**

Ranciere (2004) points out that art which has troubled the clear cut rules of representative logic (anti-realism in painting or conceptual art, for instance), has also disturbed what is taken to be commonly held, as a shared public reality, by a particular community. Aesthetic movements that have troubled representative logic demand that the community adjust their understanding of what is common (in other words, what is declared as “public” or “real” or “sensible”), until the new aesthetic movement acts as a catalyst and “an entire well-ordered distribution of sensory experience [is] overturned.” (17). Art forms of any kind that trouble any taken-for-granted paradigms about representation and reality simultaneously redefine the limits of the sensible while re-positioning the subject in relation to the sensible. As an example of this sort of historical development, Ranciere discusses the ontological and epistemological primacy of speech and action over writing and depicted images, by which the first pair is ranked as more legitimate (authentic, truth-bearing, trustworthy) than the second pair, which is seen as derivative and trace-like in its relation to the real. Ranciere argues that this ranking of aesthetic practices reflects a certain historical socio-political order that has constituted legitimate forms of participation (and positioning) within society.

One can trace this tension between speaking and writing back to Plato, who demotes writing and painting and image-making as “mute” sign systems that fail to capture the present reality of living speech. According to Plato, images are two-dimensional copies of reality and lack the fullness and truth of the community’s shared collective space. If we continue to follow the development of image making throughout the West, we can see how the introduction of optical depth and perspective in drawing and painting aims to redeem the two-dimensional image from its derivative and inadequate status. Perspective produces an image that claims to capture the act of living speech and the reality of three-dimensional space. In such art, the flat surface is meant to be endowed with “authentic” meaning (code for depth and action) and valued by the same criteria as one would use to make sense of the given present moment, the moment of speech. This realist or representational art aimed (and still aims) to capture the feeling of three dimensions more accurately than other art. But the printing press, the page, the distribution of the novel, of posters and decorative arts, marked a new form of flat imagery that re-positioned art and the citizen in ways that demanded new relationships to the contours of the sensible (Ranciere, 2004). This democratization of the “doing” of flat art afforded in turn new art forms.

The development of non-representational abstract painting can be seen as a response to this democratic distribution of flat imagery. Art historians such as Clement Greenberg (1986) describe the development of abstract non-representational painting as the reclaiming of painting’s “proper” two-dimensional medium—in other words, painting is finally entitled to explore the logic of its own appropriate place or medium or surface. Abstract non-representational art, according to this narrative, re-claims the flat surface as a two-
dimensional medium with its own logic independent from the three-dimensional space of speech and presence. Playful or absurd explorations of three-dimensional projections onto the flat surface are examples of this reclaiming of the picture plane as the “proper” medium.

LeWitt’s wall drawings were an attempt to direct our attention to the surface upon which our aesthetic sensibility seems to dwell. He was committed to exploring the way the idea or concept was conditional on, and constituted by, the surface upon which the artist worked. His aim was to trouble our easy inclination to make sense of images in terms of representation, as deferrals or sign-posts to some immaterial world beyond this one, offering art installations that helped the viewer embrace the surface as that which conditioned and constituted our notion of substance or concept or referent. Surface, in this sense, is the new substance.

By inviting others to execute art in his name, he invited the viewer to consider themselves as art maker, and dared them to make art public. His approach is meant to demystify the art making process, to make public the art making process, and to thereby alter our position in relation to both the surface and the concept that was assumed to lie behind or beyond the surface. By creating a script that can be followed by others, he creates an opportunity for all to reflect on the mechanisms by which uniqueness emerges, even within the constraints of a seemingly contained enactment. As in mathematics, the same dominant procedural discourse seems to allow for great inventiveness:

Mathematicians are not simply free to create, despite some grandiose (even child-like omnipotent) statements to the contrary. But the fact that they are not only constrained either, not simply passive observers in the face of a pre-existent (pre-ordained?) mathematical realm, that there are free as well as forced moves or choices, is one place where the possibility of an aesthetic dimension to mathematics arises. (Pimm, 2006, 178)

Turning to mathematics, one can see immediately how the issue of the “proper” surface for the given activity is a neglected area of concern. As Pimm states, “the relative propriety of those things that can be shown and those that can be said” (161) is wrapped up with the medium by which this propriety is determined. These insights borrow much from Rotman (2000) who argues that our focus should be on “the relation among the thinkable, the writable, and the sayable, that is, what and how we imagine through different kinds of sign manipulations, and the question of their mutual translatability” (62). If a new focus on surface allows learners to dwell on the materiality of the page or the shared blackboard, we might be able to shift our attention away from an iconic or referential reading of mathematical writing and graphism, to curb the inclination to invest in transcendental notions of mathematical truth, and instead explore our aesthetic positioning in relation to these signs. It may be only then that we can begin to theorize a form of agency that actually engages a learner in ways that recognize the role of surface in defining her or his subjectivity.

Through this new focus, writing or graphism can be rescued from the binary of speech/writing, and escape the burden of being only a representation, and begin to be theorized as a process of emergence, and less a process of deferral by which one records the past moments of presence and speech. I am not suggesting that mathematics is merely the manipulation of meaningless marks on paper, but that we consider how the recent
research on mathematical ideograms and diagrams and writing in general is furnishing incredible insight into the “making and doing” of mathematics (for instance: O’Halloran, 2005; Lemke, 1998; Morgan, 2005, 2006; Schleppegrell, 2007). Such research demands, as Rotman (2000) pointed out, an understanding of mathematical writing that is different from our everyday conceptions of writing.

Our commitment to immaterial, disembodied mathematical objects too often causes mathematical writing to be “invisibilized” as a “neutral and inert medium for describing a given prior reality” (47). Rotman argues, “mathematical signs do not record or code or transcribe any language prior to themselves” (44). Ideograms and diagrams are instead the “enabling technology” for mathematical thinking, and thereby rely on the material conditions through which they operate. One set of limiting conditions are the surfaces upon which these activities are inscribed, and thus it is the surface that defines our current limits of palpability. The material surface functions as an evolving determinant of our community’s practices and the subject positions we occupy in relation to the ‘real.’

[1] Pimm (163-164) refers to the group of mathematicians known as the Bourbaki who rejected the use of image or “pictorial representation” in proof.

[2] Some of his later paintings employ wild colorful swirls, resembling some of the Op Art work that he had distanced himself from, and in radical contrast to the rigor and minimalism of his earlier work. LeWitt had a long career, and explored many different forms and genres, but I am focusing only on the minimalist wall drawings, and using them to think about walls, borders, and surfaces.

References


Morgan, C. (2005). Words, definitions, and concepts in discourses of mathematics,
teaching, and learning, *Language and Education* 19(2): 103-117.


About the Author

Elizabeth de Freitas is an Associate Professor at Adelphi University. Her research interests include narrative, cultural studies, discourse analysis and mathematics education. She has published articles in Educational Studies in Mathematics, Qualitative Inquiry, Race, Ethnicity and Education, the International Journal of Education and the Arts, Teaching Education, Language and Literacy, Gender and Education, The Journal of the Canadian Association for Curriculum Studies, and The Canadian Journal of Education. She is also co-editor of the book Opening the research text: Critical insights and in(ter)ventions into mathematics education published by Springer Verlag in 2008.