

Aislinn O'Donnell

The Matter of Thinking

Material Thinking and the Natural History of Humankind

Abstract

Contemporary educational policies have recently prioritised the development of generic, core, and transferable skills. This essay reflects on this tendency in the context of the 'algorithmic condition' and those discourses that tend toward an image of education that privileges dematerialised skills, practices, and knowledge. It argues that this turn towards dematerialisation is resonant with shifts in a number of different domains, including work, and explores some of the implications of this shift. Instead I suggest an approach to education that understands it as turning towards the world, loving the world, and creating a common world. In order to understand thinking and knowing as material practices, the concept of 'material thinking' is developed that refuses binaries of theory and practice, but that instead understands thinking, particularly in educational contexts, as material and a practice of thinking with something, and a turning towards the world. I draw upon the work of Susan Oyama, Elizabeth Grosz, Tim Ingold and Isabelle Stengers, and explore the example of Barbara McClintock's research as a cytogeneticist researching maize. Here I am particularly interested in the importance of deep engagement with a subject matter in terms of developing the skilfulness that is associated with what I am calling 'material thinking'. This allows us to think about education in a way that pays attention to the plurality of practices of material thinking that engage with the natural history of humankind, and the story of the world.

Key Words

Generic Skills; Material Thinking; Algorithm; Education; Arendt; Oyama.

Matter without Materiality: The Algorithmic Turn

"Hypercapitalism is emancipating itself from its Western heritage and so-called 'values'. But this reveals a terrible panorama: capitalism without the heritage of humanism and the Enlightenment is a regime of pure, unlimited violence."¹

What are the implications for life and for thought of the de-materialising turn of contemporary finance capitalism, the rise of soft surveillance and machine learning, and the empty language of audit cultures? Can generic and transferable skills be developed independent of any form of material practice? How can thinking come to more thoroughly involve the

1 Franco 'Bifo' Berardi, (2011) *After the Future* (Edinburgh: AK Press, 2011), 31.

Aislinn O'Donnell, Maynooth University, Ireland
e-mail: aislinn.odonnell@mu.ie

Studier i Pædagogisk Filosofi | <https://tidsskrift.dk/spf/index> | ISSN nr. 22449140

Årgang 6 | Nr. 1 | 2017 | side 39-54

kind of education of the senses that is born of engagement with a specific subject matter? Do today's accelerated temporalities leave sufficient time for living, sensing and thinking given the limitations of the capacity for experience of finite animals? Is this the dawn of a new era, not of Man as Machine, but Human as Algorithm? What might a re-envisioning of the humanities and sciences involve? In response to these questions, this essay reflects on one kind of thinking, material thinking, as a riposte to the prevalence of skills talk and the algorithmic condition. It is by no means the only kind of thinking that we might come to value, but it is one particularly concerned with the education of attention. Such an education involves turning towards the reality of the world in its particularity in such a way that it is committed to preserving the world, caring for it, and to its renewal; it is an education that can nourish us and help us to live. Turning towards the world by no means guarantees the cultivation of an ethical sensibility capable of attending to the other as other, but it may sensitise us to the fact that the other exists, and can surprise us, just as the world can surprise us, be it the low light in a small Scottish village, Ai Wei Wei's untitled black and white wallpaper depicting the flight of refugees alongside barbed wire and soldiers, or the writings of Raimond Gaita on the personal nature of ethics or on saintliness.

When I question the privileging of 'generic skills' in policies and discourses purportedly concerned with education, this is nothing new. I do so in order to also draw attention to the many varieties of skilfulness implicit in and necessary for practices of material thinking across a range of domains. The matter of thinking, and of education, come alive through loving attention, be it of research, teaching or study. Here I am concerned with retrieving the important idea that education is about turning towards the *world*, and the encounter *with* the world, not first and foremost about the self, even if the self is transformed through that encounter, as it inevitably is if we are moved in our educational experiences. The recent shift to the language of learning occludes the role of the teacher in illuminating the world, the person who helps students to see, read and love the world by exploring together its rich traditions and practices. Such illumination tends to arise through the steady encouragement by teachers of practices of attention, ostension, observation, and active receptivity, staying *with* something for long enough that it might disclose itself under a different light, and hopefully, for a student, coming to see what might seem quite ordinary or uninteresting otherwise in light of a teacher's love and enthusiasm, or at least to appreciate how these forms of love keep knowledges alive. Raimond Gaita, describing the effect on him of his teacher Martin Winkler, writes "As a human being he wanted, and as a teacher felt obliged, to share what he loved with his students, hoping that they would find it worthy of their love and that it would nourish in them a love of the world, as it had in him."² This love of the world can be, at least in part, cultivated through some of the practices of material thinking that I describe later in the text. It is certainly revealed through them.

2 Raimond Gaita, Love and teaching: Renewing a common world, *Oxford Review of Education*, 38 (6), December 2012, 761-769. <https://doi.org/10.1080/03054985.2012.745046>.

In contrast to the love of the world, Franco 'Bifo' Berardi³ says that we are witnessing a de-materialising turn across work and education that undermines the possibility of educating attention. This risks forgetting the world, that delicate and fragile shared achievement of understanding, knowledge, remembering, sensing, and indeed thinking that is renewed by and with each generation and the tendency towards de-materialisation is compounded by the pressures on time that fragment attention. Material thinking sees education as part of a loving encounter with the world and as a way of understanding and communicating what it means to come to know and to love something. Creating a common world means inviting diverse perspectives, artefacts, stories and knowledges to become manifest and shareable, that is public, in a context in which there are increasingly fewer 'public spaces' or matters of public concern, and little concern for inter-generational heritages.

With the rise of generic skills-talk, the difference between the student and the worker becomes more difficult to discern. Paolo Virno⁴ claims that the new wage labourer must exemplify "habitual mobility, the ability to keep pace with extremely rapid conversions, adaptability in every enterprise, flexibility in moving from one group of rules to another, aptitude for both banal and omni-lateral linguistic interaction, command of the flow of information, and the ability to navigate among limited possible alternatives", in short, "the habit of developing no durable habits at all"⁵. Elements of this image have gravitated into global policy discourses in education and research with forms of information-talk and skills-talk that fail to pay attention to the question of education risking the precipitation of a new kind of procedural idealism when they intimate, through metaphor and image, that information and skills can exist without bodies, organisms, artefacts or matter.

The algorithmic turn, or the algorithmic condition, is not just one in which matter doesn't matter in the way that it used to; it is one that privileges anticipatory and pre-emptive logics that undo the presence required for educational attention and, with the rise of big data and machine learning, real time pedagogically tailored responses that make surprises if not impossible, then undesirable. Ben Williamson writes, "The notion of an algorithmic imaginary thus captures the Silicon Valley ideal of calculating, predicting and pre-empting human behaviours and social institutions through technical platforms that are increasingly automated and data-driven. The technocratic ideal of complete scientific calculability and technical objectivity associated with algorithmic practice underpins its approach."⁶ This algorithmic turn arguably shares, at least in part, a conceptual register with those policy approaches and discourses that foreground the importance of core, generic and transferable skills because of their purported value in preparing students for unknowable futures, or perhaps more precisely, for unknowable forms of employment, labour and work. Both

3 Franco 'Bifo' Berardi, *After the Future*. (Edinburgh: AK Press, 2011).

4 Paolo Virno, "The Ambivalence of Disenchantment" in *Radical Thought in Italy*. Eds. A. Negri and M. Hardt. (Minneapolis: University of Minnesota Press, 1996), 13-36.

5 Virno, 14.

6 Ben Williamson (2016) "Silicon startup schools: technocracy, algorithmic imaginaries and venture philanthropy in corporate education reform", *Critical Studies in Education*, 5. DOI: 10.1080/17508487.2016.1186710

algorithmic culture and skills discourses share a temporal orientation towards the (unknowable) future, both fail to adequately attend to the matter or content of common concern, both aim for control, in different ways, in response to profound uncertainty, and neither is much concerned with the love of the world.

In saying this, I do not wish to argue that the acknowledgement of skills (and competences) is wholly unwelcome or that skills are peripheral to the educational endeavour. Nor do I think that machine learning cannot offer a re-imagining of what it means to know something. However, the reification of generic skills and pre-emptive practices of algorithmic governance, combined with the bracketing of the question of the purpose of *education*, risk subordinating the practice of education to the mere transmission of generic and transferable skills that are, crucially, uncoupled from any content, field or discipline. For them the matter of education is indifferent, just as the student *qua* subject becomes irrelevant. This shift from the language of education to the language of skills and learning can also be found in personalised learning models driven by data analytics. The value system underpinning this approach is premised on technical solutions to educational problems, evidenced by a turn to 'ed-tech' and even 'neuro-education'. Even if education involves skills, it is not equivalent to skills acquisition. Knowing, thinking and understanding in education all require intimacy with the subject matter; they are the practices through which we encounter our common world, the stories of the past, the wonders of the universe, and the natural history of humankind.

For Hannah Arendt, education is concerned with the preservation and the love of the world, that is, it is concerned with conserving the rich stories of the world and humankind. For this reason, education is always about the past, that is, the world, which educators introduce to the next generation, the newcomers to our common world. Teachers introduce the world to each generation through curricula that present matters of common concern in all their richness and complexity for shared study and understanding; her definition of education makes it clear that teachers are responsible for the world because they teach children about the world, saying 'This is our world'. In her 1958 text, *The Human Condition*⁷, she describes the ways in which images of process, algorithmic logics, formalism, and bureaucracy were already becoming privileged in contemporary life, just as in her essay 'The Crisis in Education', she criticised the loss of a sense of what education involves when life skills come to be privileged over learning something⁸. These two concerns are not unconnected. Arendt sees this as part of world-alienation and superfluosity, the designed obsolescence of things, and the atomic individualism that consumerist society was bringing in its wake. The loss of *homo faber* and of things built to last leads to the corrosion of public spaces - the space of the political, the undoing of our common world, and the loss of the sense of responsibility for the world. This sense of loss is intensified in an era of big data, machine learning and the automation of work. I do not raise these concerns in

7 Hannah Arendt, *The Human Condition*. (Chicago: University of Chicago Press, 1958).

8 Hannah Arendt, *Between Past and Future: Six Essays in Political Thought*. (New York: Viking Press, 1961).

order to appeal to a nostalgic image of the human. I want to hold on to a variant of *homo faber* as the technological species but the image of *homo faber* that interests me is one that resists behavioural logics that reduce humans to a complex concatenation of data points, and that seek to intervene pre-emptively without allowing for the surprise of the educational encounter, equating education and learning with information processing or enhanced cognition, as we find in much 'ed-tech'. Materiality, matter, and bodies can easily be occluded or forgotten when bureaucratic and computational modalities of thinking over-code different and distinct fields of knowledge, including those that have both constituted and cultivated the subject matters that have occupied human thinking, life and practices over millennia. The co-imbrication of control, communication and information in the contemporary world serves to produce an image of 'disembodied' information and abstract and generic skills, which increasingly shapes social, political, economic and educational imaginaries.

Drawing attention instead to pluralistic and material practices of thinking in education encourages awareness of the ways in which humans, things and other organisms are embedded and entangled in relationships at multiple levels, from the bacteria that populate bodies to the retina's relationship with light waves, turning our attention to the world. This pluralistic, emergent and attenuated approach understands material thinking as both materially instantiated, in some form, and context-dependent, whether the matter of thought at play be the operations of symbolic logic, the solution of a mathematic equation, or the creation of a gesture in choreography. It does not seek to too swiftly sever the epistemological from the ontological. This prevents thinking from being too readily co-opted into the kind of formal and operational abstraction suggested by terms like 'generic' skills, which suggest that mastery and capacity is possible without the intimacy entailed in developing knowledge of and in a subject matter through practice in a concrete situation.

What, in any case, would skills that are uncoupled from context and content even look like? In a story called "The Great Swimmer" from Kafka's unpublished notebooks⁹, he writes,

"Hail the great swimmer! Hail the great swimmer!" the people shouted. I was coming from the Olympic Games in Antwerp, where I had just set a world record in swimming. I stood at the top of the steps outside the train station in my Hometown – where was it? – and looked down at the indiscernible throng in the dusk [...] "Honored guests! I have, admittedly, broken a world record. If, however, you were to ask me how I have achieved this, I could not answer adequately. Actually, I cannot even swim. I have always wanted to learn, but have never had the opportunity. How then did it come to be that I was sent by my country to the Olympic Games? This is, of course, also the question I ask of myself."¹⁰

Although at first glance the story of Kafka's swimmer seems absurd, arguably, it offers the consummate image for the wage labourer or student today. Across a range of human acti-

9 Franz Kafka, *Wedding Preparations in the Country and Other Stories*. (London: Penguin, 1978).

10 Kafka, 314-16.

vities, the formal and empty language of generic, core or transferrable skills prevails, in short, skills that apparently can be achieved in abstraction from material practices or engagement in study.

Bringing Thinking to Life

Understanding thinking as a material practice involves paying attention to both the *matter* of thinking and the ways in which thinking itself is *material*, for example, in philosophy, sound, film and metalwork. This is not the same as some of the other ways in which *thinking something* have been described. Gadamer described Martin Heidegger's pedagogical approach as he philosophised aloud in class, noting, "One need only recall the way Heidegger approached the lectern – the excited and almost angry seriousness with which his thought was ventured, the way he glanced askance at the window, his eyes only brushing over the audience, and the way his voice was pushed to its very limit in all of the excitement".¹¹ This exemplified thinking in action: thinking that was visible, palpable through the vibrations of the voice, following the concepts he created in speaking, as though simultaneously generating and tracking them. The thinking experience involves the most heightened and exhilarating feeling of being alive, says Hannah Arendt. She describes Heidegger's 'passionate thinking'¹² as the idea of having 'thought *something*' rather than 'thought *about something*'. Thinking *something*, she said, requires that *something* be de-sensed because the mind withdraws from the body to think.¹³ This is not quite the same as *material* thinking, that is, the 'thinking *with something*' that also involves the education of attention and the senses.

Taking up a middle or common ground between 'thinking *something*' and 'thinking *about something*', the idea of 'thinking *with something*' can help draw attention to the qualitative and experiential differences that different kinds of thinking involve, and understanding thinking as a relational endeavour. Thinking is always material whether one engages in writing philosophy, making an artwork, building a cabinet, studying the *drosophila*, or editing a film. In his short essay, "What is the Creative Act",¹⁴ Deleuze elaborates on the specificity (rather than generality) of ideas and the consequent ways in which each is manifested differently, depending on the expressive potential of their relevant different subject matters. He says of the case of philosophy, "Treating philosophy as the power to 'think about' seems to be giving it a great deal, but in fact it takes everything away from it. No one needs philosophy to think [...] If philosophy has to be used to think about something, it would have no reason to exist. If philosophy exists, it is because it has its own content".¹⁵

11 Hans Georg Gadamer, *Heidegger's Ways*. (New York: State University of New York Press, 1994), 66.

12 Hannah Arendt. "Martin Heidegger at 80" in *Heidegger and Modern Philosophy*, ed. Murray, Michael (New Haven: Yale University Press, 1978).

13 Hannah Arendt, *Life of the Mind* (London: Harcourt, 1971).

14 Gilles Deleuze, *Two Regimes of Madness: Texts and Interviews 1975-1995*. (New York: Semiotext(e), 2006).

15 Deleuze, 2006, 313.

Indeed, for Deleuze and Guattari, the specific task of philosophy is to create concepts. He continues,

“No one has an idea in general. An idea – like the one who has the idea – is already dedicated to a particular field. Sometimes it is an idea in painting, or an idea in a novel, or an idea in philosophy or an idea in science. [...] Ideas have to be treated like potentials, already *engaged* in one mode of expression or another and inseparable from the mode of expression, such that I cannot say that I have an idea in general.”¹⁶

Thinking is material not because it needs something to think *about*, but because as a practice it is always already responsive to the different expressive potentials of the matter at hand. Subject matters also have different relational qualities that emerge in encounters of bodies, things, ideas and organisms, and through such encounters, different forms of material thinking and different kinds of ideas come to be worked through and manifested. If, as J.J. Gibson¹⁷ suggests, we need the education of attention in our studies, so too do we need an education of the senses, understood comprehensively, of the kind that would allow for a deep encounter with our subject matter. For example, when the film director Andrei Tarkovsky¹⁸ said that life's logic is poetic rather than scientific, he thought that the temporal nature of film and the possibilities of editing that this medium permits might communicate poetically something of undergoing of the sensed and felt elements of experiences: 'documentary precision' and 'mechanical accuracy', in his view, bring us no closer to reality. He elaborates on the careful process involved in making a film, and the obstacles one faces: “[o]ften the director himself is so determined to be portentous that he loses all sense of measure and will ignore the true meaning of a human action, turning it into a vessel for the idea he wants to emphasise. But one has to observe life at first hand, not to make do with the banalities of a hollow counterfeit constructed for the sake of acting and of screen expressiveness.”¹⁹ Properly speaking then, the technical is itself creative: one needs to think about the distance of the camera, the long fixed shot, how one edits the temporalities of the piece, whether one allows the camera to linger on the face (Bergman), intersperse contemplative scenes of domestic interiors through the narrative (Ozu) or film photographs with a voice over (Chris Marker). Sensitivity to the matter of film and to film's potentials as a medium allows the director to develop his or her own individual style of expression, thought, temporality, materiality, and sensibility. Likewise, in the cases of forms of expression in poetry and literature – it makes a difference when a line runs into another stanza rather than retaining a sense of autonomy within a given verse, or one uses ellipses,

16 Ibid, 312.

17 J.J. Gibson, *The Ecological Approach to Visual Perception*. (Sussex: Psychology Press, 1986).

18 Andrei Tarkovsky, *Sculpting in Time*. (Austin: University of Texas Press, 1989).

19 Tarkovsky, 25.

or plays with syntax, as in the work of Beckett in *Ill Seen, Ill Said*.²⁰ “From where she lies she sees Venus rise. On. From where she lies when the skies are clear she sees Venus rise followed by the sun. Then she rails at the source of all life. On.”²¹ The possibilities are many. Material practices and expressive manifestations differ in accordance with one’s concern, sensibility and depth of understanding or imagination: space, the archive, fossils, the conversation, the remnant, code, the genome, or oral histories with living beings, the stories of non-monumental everyday life.

Tim Ingold writes that “[.] it is a fallacy—and one that is found very frequently in archaeological writing—to suppose that objects are ever finished in this sense. For one thing, their forms are not imposed by the mind, but arise within the movement of the artisan’s engagement with the material; another, in the course of being used for one purpose, objects may undergo further modification that make them peculiarly apt for another.”²² He suggests that like humans, objects have histories, and that we ought to acknowledge rather better the ways in which relationships and practical engagement with one’s surroundings are both formative and constitutive. The notion of a ‘blueprint’ model of design, by which an author or maker has an idea which then he or she realises, fails to comprehend the ways in which people wrestle with their subject matter and do not know how those engagements and tussles will end, unlike cases of generic skills talk where no resistance is offered by the world. Ingold describes the way in which learning occurs as guided rediscovery, showing, and the education of attention, noting that observation need not be that of the distanced spectator but “requires the observer to place himself or herself, in person, in a relation of active, perceptual engagement with the object of attention [..] There can be no observation without participation, no explanation without interpretation, no science without engagement.”²³ Careful listening, responsiveness and attention to the (subject) matter before each of us invites new ways (for us) of perceiving, sensing, understanding and thinking, and confounds the hylomorphism implicit in some constructivist conceptions of education. Becoming more concerned with the world and its stories, including one’s complex biography and perspective, is part of the practice of education and becoming educated, that is, loving the world. Like William Connolly²⁴ and Jane Bennett,²⁵ I am interested in a delicate, even irreverent, ethics of responsiveness and response-ability that is grounded in a relational ontology that invites curiosity and interest.

20 Samuel Beckett, *Company/Ill Seen, Ill Said/Worstward Ho/Stirrings Still*. (London: Faber and Faber, 2009).

21 Beckett, 51.

22 Ingold, 2001, 263-4.

23 Ibid, 276.

24 William Connolly, *The Fragility of Things*. (Durham: Duke University Press, 2013); William Connolly, *A World of Becoming*. (Durham: Duke University Press, 2011).

25 Jane Bennett, *Vibrant Matter: The Political Ecology of Things*. (Durham: Duke University Press, 2010). <https://doi.org/10.1215/9780822391623>; Jane Bennett, “The Force of Things: Steps Toward an Ecology of Matter”, *Political Theory* 32, no.3 (2004): 347-372. <https://doi.org/10.1177/0090591703260853>.

Apprenticeships in Thinking

As Tim Ingold²⁶ points out, “A skill like playing the cello, being a property of the organism established through practical experience in an environment, is every bit as ‘biological’ as walking on two feet”.²⁷ The practical experience is vital here. Even if some aspects of skills are transferable, whatever this may mean, they begin and are cultivated in some form of practice. Conceptualising skills as a form of material thinking is to say that skills involve thinking *with* something, attending to it in its particularity.

Of course, in the fields of epistemology and cognitive science where a good deal of criticism has been levelled at the idea that knowledge can and must be ‘abstract’, this is hardly unfamiliar territory. Francisco Varela argued that “proper units of knowledge are primarily *concrete*, embodied, incorporated, lived” when he explained his enactive approach to cognition that emerges from practical engagement with the world.²⁸ We might in turn think about other ways of understanding knowledge by re-imagining traditions of thinking. Refusing the split between the arts, humanities and human sciences, on the one side, and the natural sciences on the other, Tim Ingold states “[...] there can be no absolute division of method and objective between studying the lives and works of humans and of nonhumans. Why, then, should the participatory and interpretative approaches of the arts and humanities be limited to the study of human subjects? And why, conversely, should the observational and explanatory approaches of science be limited to the domain of nonhuman “nature”? Why, indeed, should these approaches be separated at all?”²⁹

Philosophers like Gilbert Simondon³⁰ and Jane Bennett have questioned the value and validity of hylomorphic approaches to thinking about matter by which (active) form shapes (passive) matter. Today in the wake of *homo bureaucaticans*, and in the context of the algorithmic condition, some of the images and discourses that accompany the concepts of ‘transferable’ or ‘generic’ skills’ seem to imply that skills can be not only uncoupled from material practices, but even developed without any subject matter, operating effectively regardless of context, or any content. Practices of thinking in different fields involve acts of discovery and creation. Bennett prefers, she says, those encounters with creative materiality that anyone who is intimate with *things* experiences. She includes in her list artisans, mechanics, cooks, builders and cleaners, though we could readily extend that list to the

26 Tim Ingold, “Beyond biology and culture. The meaning of evolution in a relational world”. *Social Anthropology* 12, 2004: 209-221. <https://doi.org/10.1017/s0964028204000291>; Ingold, T. (2011) *Being Alive: Essays on Movement, Knowledge and Description*. London: Routledge; Tim Ingold ‘From Complementarity to Obviation: On Dissolving the Boundaries between Social and Biological Anthropology, Archaeology, and Psychology’ in Oyama, S., Griffiths, P.E., & Gray, R.D. (Eds.) *Cycles of Contingency: Developmental Systems and Evolution*. (Cambridge: MIT Press, 2001), 255-280; Tim Ingold, *The Perception of the Environment: Essays in Livelihood, Dwelling and Skill*. (London: Routledge, 2000).

27 Ingold, 2004, 216.

28 Francisco Varela, “The Reenchantment of the Concrete” in *Incorporations*, eds. Jonathan Crary and Sanford Kwinter, (New York: Zone Books; 1992); Francisco Varela, Evan Thompson & Eleanor Rosch (1991), *The Embodied Mind*. (Cambridge: MIT Press, 1991).

29 Ingold, 2001, 274.

30 Gilbert Simondon, *L'Individu et sa genèse physico-biologique*. (Grenoble: Éditions Jérôme Millon, 1995).

'things' of the humanities and the sciences more broadly. The intimacy of the relation of metalworkers with their material allowed them to discover the 'polycrystalline structure' of non-organic matter. Through a tacit knowledge of their 'protean activeness', metals could be worked with and upon. This image of creative materiality can be extended beyond the examples offered by Bennett in order to follow the inter-play of practitioners in any field with the material with which they are in dialogue. One can witness skilfulness in the practice of the cytogeneticist, skilfulness that is embodied, embedded, emergent and contextual, as described so well by Evelyn Fox Keller³¹ in her biography of Barbara McClintock. By *seeing* material practices of thinking in action, one grasps the immanent process through which each question or intervention opens up different possibilities for understanding and action. Skills cannot exist in a realm that is divorced from the exercise and practice of specific, embedded and embodied activities. Oyama, Ingold, Grosz and Fox Keller invite us to begin to dismantle a nature/culture divide or a gene/organism divide that abstracts certain entities in order to give them causative power, as though they could exist beyond the material world with which they co-evolve.

In Susan Oyama's work in developmental biology, we can find an analogous set of concerns about 'info-talk' from those we encounter in those kinds of 'skills-talk' that promote generic context-independent and content-indifferent skills, and that are indifferent to both the knower and the known. When she³² describes her worries about the 'de-substantialisation' of her field of knowledge – developmental biology, she takes issue first and foremost with the way in which the language of genetics appears to be able to do without materiality. The following quote illustrates this tendency, "Genetic information is said to be weightless and independent of its material substrate; for evolutionary biologist G.C. Williams it dwells in a "codical domain" separate from the physical one".³³ So too, Richard Dawkins³⁴ claimed that "life is just bytes and bytes and bytes of digital information",³⁵ "[...] a river of information, not a river of bones and tissues: a river of abstract instructions for building bodies, not a river of solid bodies themselves. The information passes through bodies and affects them, but it is not affected by them on its way through."³⁶ This is not meant to offer a metaphor for life, but is meant to be taken quite literally. Oyama calls this kind of talk 'info-talk' whereby information's power seems to stem from (a magical) abstract immate-

31 Evelyn Fox Keller, *A Feeling for the Organism: The Life and Work of Barbara McClintock*. (New York: Henry Holt, 1984).

32 Susan Oyama, *Evolution's Eye: A System's View of the Biology-Culture Divide*. (Durham: Duke University Press, 2000a); Susan Oyama, *The Ontogeny of Information: Developmental Systems and Evolution*. (2nd ed.). (Durham: Duke University Press, 2000b); Susan Oyama, Paul E. Griffiths, & Russell D. Gray. (Eds.), *Cycles of Contingency: Developmental Systems and Evolution*. (Cambridge: MIT Press, 2001); Susan Oyama "Compromising Positions: The minding of matter" in Anouk Berberousse, Michel Morange & Thomas Pradeu (Eds.) *Mapping the Future of Biology*. (Netherlands: Springer, 2009).

33 Oyama, 2009, 27.

34 Richard Dawkins, *The Extended Phenotype: The Gene as the Unit of Selection*. (Oxford: Oxford University Press, 1982); Richard Dawkins, *The Selfish Gene*. (Oxford: Oxford University Press, 1976).

35 Oyama, 2009, 36.

36 Ibid, 41.

riality. She argues that information is deified in the work of people like Dawkins and Daniel Dennett,³⁷ saying that, “The sprawlingly heterogeneous usage of information has only been touched on here, and part of my point is that the search for a one-size-fits-all organizational principle is misconceived”.³⁸ She notes that “[r]hetorically making matter disappear also encourages neglect of the histories and concrete arrangements – time and space – that generate biological marvels, and makes it harder to communicate them effectively.”³⁹

Oyama says, “Our cognitive and ethical responsibilities are based on our *response-ability*, our capacity to know and to do, our active involvement in knowledge and reflection”.⁴⁰ Irresponsible approaches might include making ungrounded claims and statements, blithe indifference to evidence, or refusing to look at alternative arguments in a field like philosophy. It is not only those working in the sciences who must respond to and think with their subject matter. Those of us engaged in study, research and practice in the arts and humanities will be familiar with the experience of resistance and ambiguity of the material with which we are dealing. Much as we might *like* to make an argument or offer a particular interpretation, the material can be recalcitrant; it won't be forced into a position it doesn't 'like'. We undertake careful processes of writing, reading, and of editing. We work to develop ideas, interpretations and arguments. We try to frame in a way that is generous and faithful to the subject matter. We try to ensure some kind of continuity or resonance between different elements, even in forms of experimental writing or philosophy. We seek ways for heterogeneous elements to communicate in installation and film. This is a matter of co-construction and interaction that also involves an ethical dimension.

Isabelle Stengers,⁴¹ Susan Oyama and Elizabeth Grosz⁴² offer alternative visions that are born of different ways of thinking about method and understanding in the sciences and the humanities and drawn from careful descriptions of practices. Rather than policing disciplinary boundaries, these thinkers are critical of dominant descriptions of the practice of research and thought in these domains. Their insights are particularly useful as we reflect on what it is that we *do* in the humanities, the arts, and the sciences. Of value are sustained engagement, the cultivation of responsiveness, the capacity for judgement and the kind of creative attention that slowly emerges through deep, loving and intimate familiarity with a subject matter. The kind of skilfulness involved in these practices of 'material thinking' cannot be taught in abstraction from content nor is it readily transferable to other domains. Rather, the sustained interplay and dynamic relation with subject matter is part of an immanent process of thought that is attentive to and faithful to the *matter* of thought.

37 Daniel Dennett, *Darwin's Dangerous Idea*. (New York: Simon & Schuster, 1995).

38 Oyama, 2009, 42.

39 Ibid, 43.

40 Ibid, 149.

41 Isabelle Stengers, *Invention of Modern Science*. (Minneapolis: University of Minnesota Press, 2000); Isabelle Stengers, *Power and Invention: Situating Science*. (Minneapolis: University of Minnesota Press, 1997).

42 Elizabeth Grosz, *Becoming Undone: Darwinian Reflections on Life, Politics and Art*. (Durham: Duke University Press, 2011).

When Oyama argues against reductionist conceptions of genes as sole causal factors or drivers of evolution in favour of a nuanced, context-driven constructivist model of evolution, she argues that this is more faithful to the complex and material development of living beings, whilst Grosz's turn to Darwinian sexual selection allows her to frame the pursuit of understanding in the sciences and humanities in a language that is non-instrumental. Just as the bird cannot justify its song, it is absurd to ask humans to justify the many forms of expression and interest that are constitutive of *homo sapiens* as a linguistic, cultural, social, artistic, creative form of life, even if, as Nietzsche notes, man is an indeterminate animal.

Although Oyama's writings are concerned with information in the context of genetics and developmental biology, her thoughts are instructive for those of us concerned by the de-materialising turn in skills talk and its implications for education. "[I]nformation is not some mysterious stuff, capable of being transmitted from one place to another, translated, accumulated, and stored; rather it goes out of kinds of relations. For Gregory Bateson⁴³ information is a difference that makes a difference. This invites questions: a difference in what (what are you paying attention to?), about what (what matters?), for whom (who is asking, who is affected?). Asking these questions leads us to focus on the knower, a knower who always has a particular history, social location and point of view".⁴⁴ Oyama claims that scientific knowledge has been habitually disembodied and the use of the passive voice erases the context specificity of the knower, including her cares, interests, perspectives, worries and power relations, such that we place no value on even the romance of discovery described by Whitehead.⁴⁵ This also reveals the politics of knowledge; questions of method or legitimacy can become framed in such a manner so authoritative that no dissent is brooked, which then forecloses other ways of understanding and describing pathways to knowledge and understanding. She states her own position clearly. Speaking of biology, she asks that rather than seeking timeless truths, we might come to "appreciate *particular* perspectives as vehicles for empathy, investigation, and change [...]".⁴⁶

Material Thinking: The Matter of Thought

It is not the case that the humanities have a somehow separate and special vocation from the sciences, even if they have had a tendency to make a *tabula rasa* of their forbearers, forgetting the human is also animal, a living organism, part of a long evolutionary lineage, co-emergent with multiple forms of life and matter, co-constituted by and with the technologies that change human capabilities, and inheritor of rich cultural traditions, beliefs and practices. So too have the natural sciences their own blindspots which is why Stengers

43 Gregory Bateson, *Steps to an Ecology of Mind*. (New York: Ballantine Books, 1972); Gregory Bateson, *Mind and Nature: A Necessary Unity*. (Toronto: Bantam Books, 1979).

44 Oyama, 2000a, 147.

45 Alfred North Whitehead, *Adventures of Ideas*. (New York: The Free Press, 1967).

46 Oyama, 2000a, 149.

asks scientists to allow themselves to be “confronted with the manifold richness that they have for so long given themselves the right to forget. From now on, they will be faced with the problem that some have wanted to reserve for the human sciences – whether it be to elevate or to diminish them – the necessary dialogue with pre-existing knowledges concerning situations familiar to everyone. No more than the sciences of society can the sciences of nature forget the social and historical roots that create the familiarity necessary for the theoretical modelising of a concrete situation.”⁴⁷ This she describes as a poetic listening to nature, using ‘poetic’ in its etymological sense. This emphasis on the concrete situation is important; the form of engagement is determined by the concrete materiality of the situation so it is important to consider the kinds of reasons that are offered for decisions made to bracket, suspend or ignore aspects of that situation, such as the weather, or the soil.

Whatever subject matter we have come to love – and this is surely the hope of the educator that someone will not only come to learn something, but to love something – we will feel an affinity with the words of Shirley Strum when she says “to understand them I take the risk of loving them, that is of being transformed by them”. Strum speaks of her baboons in a way that is at odds with those conventional scientific discourses that emphasise the importance of neutrality, a particular form of objectivity, or that demand replicable methodology. In this spirit of loving attention, Stengers notes how “McClintock tracked down the singularity of the genetic material of the corn she was studying, she defined it with precision and relentlessness [...]”⁴⁸ She names her “intense jubilation”, her empathy, which enabled her to descend ‘into’ the cells she was examining”, allowing her to *understand* in “the most intimate sense of the term”.⁴⁹ McClintock laughed when her corn surprised her: for her, corn was capable of reacting.

Evelyn Fox Keller observes that “the research readily takes on the appearance of a conversation: the riposte has all the unexpectedness and charm that one finds in the response of an intelligent interlocutor.”⁵⁰ Indeed, McClintock herself says, “If only we were content to let the material speak”.⁵¹ When we are open to listening to the material then we can learn through encounter, surprise, study, attention, and experience to ask the right questions. Stengers reflects on this saying, “But from the moment she chose to no longer make use of corn but to learn ‘with’ it...”⁵² This is part of what education involves: the task of any practitioner is to come to learn *with* and think *with* the material, be it navigating archives, a body in a yoga posture, the feel of a grain of wood or the genesis of a philosophical concept. As Stengers describes corn’s entangled histories, “its reproduction, its development, ... its growth in the fields where it experiences the sun, the cold, predatory insects and so on”, she says quite firmly, “Indeed scientists should not accumulate ‘neutral’ observations

47 Stengers, 2000, 46.

48 Fox Keller, 112.

49 Ibid, 115.

50 Ibid, 124.

51 Ibid, 126

52 Stengers, 1997, 129.

about corn, but learn from it which questions to ask it, because like every historical being, corn is a singular being. And to say 'corn' is already to say too much ... (ibid, 127). What is special, for her, about the science of evolution is that it precludes the power to judge *a priori*, as it discovers the need to put to work a more and more subtle practice of storytelling. McClintock's descriptions of her own practice of coming to learn about her corn helps us to gain insight into the practical efforts of what it means to come to know something. Her stories communicate the vitality of a patient relation of ethical and creative attention that values the kind of understanding that can only emerge through sustained and careful observation. It is an exercise that shows what it means to come to love the world, and that values the world simply because it is, it exists.

Elizabeth Grosz also resists the invocation of instrumental language to justify the existence of the humanities though she also wonders what intellectual revolution would need to occur such that they might be re-imagined "to make man, and the various forms of man, one among many living things, and one force among many, rather than the aim and destination of all knowledges [...]".⁵³ In seeking out the 'inhuman' in the humanities, and the affinities between humans and other sentient beings (and for Bennett this also would include inorganic matter like chemical compounds to basalt or tin cans), she refuses to justify their existence by appealing to their utility, however worthy, in cultivating character, citizenship or competence. The expressiveness of diverse forms of life, as described in the writings of Darwin, leads her to ask: What if the borderline between the humanities and sciences were to become less secure, more open, more interactive without being reductionist on either side?

What if we were to become better attuned to the eroticism of language, the sensuality it invites, be it in birdsong or poetry, and the pleasures it creates? Darwin's writings on sexual selection show how he clearly distinguished sexual selection from natural selection. Tool-making, seduction, language, decoration, love, curiosity, and pleasure are not specific to the human species, and if we allow ourselves to reflect on these areas of common endeavour and experience, we might come to dismantle the abyss of separation between the human and the animal. Engagement in these activities is part of what it is to be a living human being, just as the bird sings or the beaver builds a dam. To attend properly to the stories of all beings, animate and inanimate, requires an apprenticeship in material thinking.

In Conversation with Matter

In both the sciences and the humanities, we develop skilfulness through engagement and conversation with our subject matter. Thinking *with* something undoes the notion that thinking only takes place in the Cartesian, or even computational, mind. Material thinking demands a dialogical, rigorous and sensitive disposition and a skilfulness that needs

53 Grosz, 13.

something 'other' than itself. The language of probing, enquiry and investigation seems, sometimes, to rather better communicate this. Richard Sennett's comments in *The Craftsman*⁵⁴ are useful in this respect. Although he focuses on the making of concrete things, his insights are also important for those domains such as the humanities that are sometimes wrongly construed as 'immaterial', as only 'theory'. These disciplines and fields also involve a relation to the world and are usually manifested in material forms such as texts, archives, film or voice. He asks "[w]hat the process of making concrete things reveals to us about ourselves", adding "[l]earning from things requires us to care about the qualities of cloth or the right way to poach fish [..]".⁵⁵ Sennett's sense of what it is to do something well involves a fidelity to the 'thing itself' and requires "skill, commitment and judgement".⁵⁶ If "every good craftsman conducts a dialogue between concrete practices and thinking",⁵⁷ as Sennett argues, it might help to begin to re-conceive the practice of subjects in the humanities and sciences in terms of the material knowing and thinking of craftsmanship, not in terms of a pre-conceived end product, but rather by attending to the sensitive manner in which a craftsman works with his or her material. Sennett makes the following arguments in respect of his understanding of skills. "[F]irst all skills, even the most abstract, begin as bodily practices; second; that technical understanding develops through the powers of the imagination".⁵⁸ The process of learning involves learning from the resistance and ambiguity of the given material, and the facility to improvise develops over time. He argues against any simplification and rationalisation of skills, such as a teacher's manual; because we are complex organisms, manuals simply cannot capture the elements and relations at play.

What if we were to tell the stories of the matter of our subjects and why they matter, as teachers, students, and researchers, detailing the subtle practices of storytelling that they demand? We could communicate practices of thinking responsive and in dialogue with their material, the need for deep attention in study in these areas, and the tension of this with the direction of contemporary life and its world-alienation. We might tell of our reservations about the meaningfulness and relevance of much of the *a priori* skills language that abounds, our refusal to subordinate educational aims to the short-term objectives of business, and resist servicing dominant discourses by re-framing our research within an instrumental rationale. We could refuse to apologise, and ask how we might retrieve a sense of our world and the natural history of humankind, a history far richer than the caricature of *homo economicus*. We could ask what possibilities are offered to a human life to explore the world, becoming attuned to the human as a being in becoming, a human who is natural, historical, cultural, linguistic, expressive, desiring, creative and sensual. When we witness the expressiveness and lack of utility of so much of nature, why do we feel compel-

54 Richard Sennett, *The Craftsman*. (New Haven: Yale University Press, 2009).

55 Sennett, 8.

56 Ibid, 9.

57 Ibid, 9.

58 Ibid, 10.

led to impoverish our understanding of human existence, and tie it to key performance indicators? Why do we feel we need to justify life? Cultivating skilfulness in material thinking returns us to the rich materiality of the world and to practices of education that allows us to singularise each of our existences with all the exuberant superfluity of life, and come to both conserve and love the world.