



Love Affair with an Idea: Commentary on *Wild Experiment: Feeling Science and Secularism after Darwin* by Donovan Schaefer

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In this review essay, I discuss how, in writing this book on how thinking is feeling, Donovan Schaefer is having a passionate love affair with an idea, how he pulls the bow string as far and still not enough to the point of breaking. I have three remarks/points of concern/comments specific to the outline of cogency theory. First, *how* thinking is feeling? If thinking is feeling is a process, how does it happen? Secondly, where does reframing science/knowledge as thinking is feeling take us? How can it reframe what we mean by science? And lastly, who is the thinking-feeling scientist-subject?



“This is an essay about a love affair with an idea,” Donovan Schaefer quotes Silvan Tomkins beginning chapter 2. Reading it came another remarkable line in my mind,

(and I think silently:

love is a bow-string pulled

back to the point of breaking)

(*Poem of the End*, Marina Tsvetaeva translated by Elaine Feinstein, 1971)

In this review essay, I want to discuss how, having a passionate love affair with an idea, Schaefer pulls the bow-string as far and still not enough to the point of breaking.

Before I come to my remarks, I would like to remember Evelyn Fox Keller, her towering personality, her era-defining, pioneering, brave biography of Barbara McClintock published in 1983 that gave a whole new dimension in the way we understand affects and emotions in relation to the making of science. Personally for me her work has a life-changing inspiration on my own exploration of how all forms of knowledge emerge from deeply personal and emotional place. I would like to quote here what Keller wrote to me in 2018 after reading the draft of my book *Affective History of the Gene: Who is the Scientist-Subject?* about to be published by Routledge at that time (Shah 2018). In her email, Keller applauded my ambition, calling me a brave woman, “Indeed, yours is an ambition that I shared quite fully in my early work in the history and philosophy of science. Certainly, to bring the affective springs of scientific reasoning to the fore was a central aim of my McClintock book, and even more explicitly so, of *Reflections on Gender and Science*.” Keller described her book on Gender and Science as psychoanalysis of science. But then her tone turned somber when she wrote, “Ultimately, however, I gave up. The resistance in the history of science community to any kind of subjective analysis...was just too strong.”

I don't think Keller ever gave up, and still she felt a sense of being defeated with regards to her pioneering work on emotions and science. I wish she were here. Because 4S awarding Ludwik Fleck prize to Donovan Schaefer's outstanding contribution on how thinking is feeling has vindicated the whole community of scholars working on similar themes. I feel deeply honored to have been asked to participate in this moment of celebrating Schaefer's book that has opened up this space for the discussion on the topic that at best is marginalized and at worst treated with suspicion and occasionally even subjected to antagonistic aggression.

Reading Donovan Schaefer's book has been an experience. At times I felt almost dizzy as his intellectual range is breathtaking. Schaefer effortlessly engages with a vast range of topics normally not discussed in one breath, in one book. He gives us an outline of cogency theory on how thinking feels and then debates it in relation to racialized reason, secularism, Darwin and Huxley

and their science, new findings in neuroscience, creationism and more. Each chapter is like a stand-alone episode of the most gripping drama, reading which I had a Hitchcockian feeling—never a dull moment. The book is a page-turner. The nuance, the richness, the poetics of Schaefer's prose—the book is indeed a testimonial of a passionate love affair with an idea.

Let me now elaborate on how Schaefer pulls the bow string as far and still, I intend to argue, not enough. I have three remarks/points of concern/comments specific to the outline of cogency theory. First, I want to unpack *how* thinking is feeling. If thinking is feeling is a process, how does it happen? Secondly, where do reframing science/knowledge as thinking is feeling take us? How can it reframe what we mean by science? And lastly, who is the thinking-feeling scientist-subject?

I want to first unpack what I believe is one of the key statements of the book, “knowledge-making is not just entangled with feeling, as some claim (*Feeling can shape how we think, under certain circumstances*), but encompassed by it (*Feeling is necessary for thinking; there is no thinking that is not feeling*)” (Schaefer 2022, 5, emphasis original). I see here two separate statements that I would like to discuss, although Schaefer does not make such distinction as I do. One, feeling is necessary for thinking, and second, there is no thinking that is not feeling.

Schaefer explores how thinking is feeling with interconnected tropes: click and agonism of emotions culminating into what he calls cogency theory. Schaefer writes how all forms of knowledge is formed by inseparably combined effect of thinking and feeling, how knowledge-making are versions of micro-level delight in the subtle click of things coming together. Click is how it feels when pieces of information coalesce, when knowledge-making is solving puzzles that draws us into pleasurable sphere of playing by thinking—Schaefer writes. Schaefer variously describes click—it happens when we organize a maze of noise into a tidy whole, we piece together secrets, when we derive the joy of solving good mystery, when a detective story neatly wraps up elements of a plot in a satisfying resolution, when we thrill to the immaculate resolution, we experience a symphony of details coming together in sudden alignment. Click is the conceptual trope that binds whole of Schaefer's book together. How do pieces of information coalesce? How do details come in alignment producing a click? Even when Schaefer's click relates to both product and process of the knowledge-making, it is more than often described as a product, an outcome of the knowledge-making—click is when details fall in alignment. I want to particularly focus on unpacking how click may relate to the processes of knowledge-making.

Here I would like to refer to Loraine Daston's concept of “jizz,” which further refers Ludwik Fleck's work on genesis of the scientific fact, which is remarkably close to Schaefer's click, except that Daston and Fleck explore the processes by which thought and emotions collapse into a unity. Daston (2008) explains how the jizz in scientific observation is sure, swift, silent, and happens without

a pause for mental analysis. She further explicates how learning to see like a scientist is a matter of accumulated experience, a matter of habit formation, how the scientist has to go through a gradual process of training before experience turns into a habit whence for a mature scientist it becomes possible to see things all-at-once, like a jizz. Daston further clarifies, while the scientist is seeing things all-at-once, in a jizz, the conscious reason has no idea how this is done, how conscious knowledge is formed here by unconscious habits and intuitions. Daston here refers to Ludwik Fleck's interpretation of thought collective and genesis of the scientific fact explained in a musical metaphor. It all starts with the confused notes which is followed by hummed and inaudible tunes gradually turning into a melody. The melody turns into a thought collective once the "co-workers" listen and tune their sets until these became selective. The melody could then be heard even by the unbiased person—meaning, it crystallizes into a fact (Fleck [1935] 1981). There is a similarity between Daston's experienced scientist able to see in a jizz, all-at-once, because a chain of experiences turn into unconscious habit, and Fleck's genesis of the scientific fact emerging first as chaos, then confused notes, then collective tuning into a melody—both are processes, they are emergent, subjected to time, and both constitute a chain of embodied experiences that are silent and swift, intuitive and unconscious, while they form and structure rational reason (Shah 2017).

What is remarkable about Daston's exploration of jizz and Fleck's genesis of melody is that the subtle ways in which the irrational and rational, conscious and unconscious, feelings and thought, experience and fact are seen as coalescing in place. Here the emergence of the conscious scientific reason has to necessarily go through the path of the unconscious. The way perception turns into memory into experience into habit has psychology, and yet again, the conscious reason have no inkling how it is done when it is done. This all-at-once-ness in Daston (2008) is explained in the words of Descartes, "the arguments so speeded up that it bursts upon the mind as a single cognitive event" and "[n]o amount of explicit reasoning, even mathematical reasoning, can compete with it."

I interpret and relate Schaefer's first statement—*feeling is necessary for thinking*—with Daston and Fleck's exploration of the play of the conscious and unconscious, reason and intuition, in the making of knowledge. The jizz, all-at-once-ness, is not about some random eruption of unconscious upon the conscious. This is about the unconscious fundamentally structuring the conscious reasoning without the conscious even knowing it. In fact, this is about the indispensable necessity of embodied experiences turning into unconscious habit for any conscious knowledge to form.

Even when Schaefer acknowledges the role of unconscious in the making of knowledge, the thinking is feeling is still predominantly conscious process. The cogency theory is inspired by Micheal Polanyi's idea of tacit knowledge absorbed through embodied experiences and intuitions and persuasive passions rather than

abstract language. Schaefer in fact argues that selection of Thomas Kuhn and his work on structure of scientific paradigm instead of Michael Polanyi as gadfly of science studies is why feeling/thinking binary still has such power. Schaefer also further discusses the portrait of a multilayered self in affect theory—how this self is a continuum from micro to macro stretching both within and below our field of awareness (Schaefer 2022, 65) and how affect theory lights up the interior of reason below the threshold of consciousness awareness shapes how we think (2022, 70)—the cogency theory is still significantly tied down to a very conscious, carefully configured or constructed or calibrated, amalgamation, agonism, of emotions in the making of knowledge (2022, 34–36, 55). The role of psychoanalytical unconscious in creating multilayered affective self either emerging from or challenging Freudian traditions is briefly discussed in the chapter on affect theory and still not persuasively incorporated in the cogency theory. How the click happens as a complex, below the surface of consciousness, process in which how *feeling is necessary for thinking*, is not convincingly explored. This has consequences for the theory of emotions in the making of the scientist-subject or knowledge-seeker, I return to this point later in my remarks.

Discussing the second statement—*there is no thinking that is not feeling*—Schaefer makes repeated references to how thinking feels involve pleasure, joy, curiosity, playfulness, how it's a longing, a need, a passion for intellectual beauty. And then Schaefer also refers to what he calls countervailing forces such as shame, fear, anxiety, and frustration of not able to solve the puzzle, and embarrassment and nervousness the possibility of error or being wrong may cause. Schaefer argues how scientific rationality is a carefully constructed amalgam of feelings in tension; how science is born in an agonism of contesting emotions; how cogency means confluence and contest of forces in agonism, a struggle for different priorities; how good knowledge is the product of complicated operations of feeling—an agonism, an invisible clashes of forces holding our desire to know the world in tension; how agonism of intellectual feelings is the real driver of good knowledge; how knowledge production collapses when this emotional agonism is removed; how we feel our way to knowing via a rich agonism of pleasure and frustration (Schaefer 2022, 9, 12, 16, 19, 36, 41, 48, 54). Even when Schaefer anchors his cogency theory on emotional agonism that oscillates between excitement and frustration, my impression is that the exploration of feelings remains overwhelmingly on the side of the pleasure principle. Joy of discovery, exhilarating sense of science, research as compulsive excitement, intellectual passion comprising curiosity and playfulness, role of intuition, persuasive passion, love of elegance or beauty, the subtle joy of pieces of information snapping together, joy and exhilaration as guidelines of scientific method, discovery as an indescribable pleasure which pales the rest of life's joys, to pursue truth is pleasurable dancing with sentiment of rationality, transition from a state of puzzle and perplexity to rational comprehension is full of lively relief

and pleasure—these are some of the expressions repeatedly appear throughout the book. And of course there is agonism of countervailing emotions. But what about the rest, the whole complex spectrum of humanly possible emotions? What about the human subjectivity firmly grounded in complex interplay of emotions? And this is where I construe that Schaefer's cogency theory gets on the defensive backfoot. There are a series of statements in which this is visible.

If cognition is felt, it is *susceptible* to the affective ecology from which it emerges. Knowledge production is emotional, so it is always *at risk of messing* together with the *other spreading inkblots* of feeling making up our embodied lives (Schaefer 2022, 11). Wheeling matrixes of feeling *lure* us to *misbegotten* belief (2022, 11). If knowledge is felt, it is always in intimate proximity to *other things we feel*—things we want—including our *secretly savored prejudices* (2022, 29). Science as a felt process that registers the way things are in the world produces good knowledge, but it's also *susceptible to contamination*. It *messes together with the other emotions* that give form to our social, embodied lives (2022, 8). If reason is itself a passion, then it messes together with the *other feelings* that define our lives. It eats (*messes*) at the same table with them, and it *sloshes around (messes)* in the same cup, creating a strange brew of felt intuitions from which thought emerges, dripping (2022, 8). How powerful *prejudices* “seep” into our intellectual bedrock (2022, 11). Science as a felt process that registers the way things are in the world produces *good knowledge*, but it's also *susceptible to contamination*. It *messes* together with the other emotions that give form to our social, embodied lives (2022, 8). Good knowledge . . . is the product of complicated operations of feeling—an agonism, an invisible clash of forces holding our desire to know the world in tension and trying to outmaneuver *other felt priorities that might muddy the waters* (2022, 12). Knowledge is always *susceptible to being pulled off course* or landing awkwardly on skewed surface (2022, 18). By studying how rationality works by feeling its way along offers our best chance to name and cultivate the habits and dispositions that make up the sense of science and *veer away from the traps* set by our own sweet tooth (2022, 24). Scientific rationality as carefully calibrated configuration of intellectual passions in tension is always *susceptible to conservative tilt that can obscure truth* (2022, 55). Because rationality is affective, it's *susceptible to contamination* by *other emotional ink-bolts* surrounding it (2022, 70). Because secular reason is emotionally determined, it is susceptible to messing together with other desires and preferences (2022, 84). Science's *susceptibility to contamination* by racism and sexism (2022, 222). (Emphasis mine in all quotations.)

I want to unpack here the notions of other emotions and good knowledge. On the two extremes of the spectrum of agonism of emotions are pleasure and joy of the click on one side and shame, fear and frustration of failing to achieve click on the other side. Both these sides remain firmly anchored on the epistemic, intellectual components of doing science—click is when puzzle is solved and frustration, shame and embarrassment when it doesn't. In between

are other emotions that variously mentioned in the quotes above, and some of them produce—worry, concern, anxiety, unease. The cognition as feeling is susceptible, at risk of messing up with other feelings, including savored prejudices, it is susceptible to contamination, again, of other emotions. The choice of the lexicon contamination appearing throughout the book assumes there was something that was pure and then it got mixed up with bad stuff. If there was no origin purity then there can't be contamination; if it never was pure then it was always already contaminated; if there is no original then there can't be copy because then all are only copies. But even if the choice of the word contamination may not be that consequential as I might be projecting, still, there are multiple expressions in Schaefer's book involving susceptibility to other emotions that form the core of the discussions on conspiracy theory and racialized reasons. The message comes out of these discussions that make me feel uncanny—we need to be beware of other emotions, possible contaminations, risks, susceptibilities, prejudices, misbegotten beliefs. Oopps, there are emotions in the vicinity, be careful, when you open the pandora's box!

Anchoring cogency theory in the agonism of emotions as the conceptual lexicon is intriguing. The term "agonism" derives from the Greek "agon" meaning "painful struggle, conflict and competition or dispute" (Oxford English Dictionary). The meaning of agonism of emotions then presupposes separate categories of feelings or emotions in conflict—the good, bad and ugly—the pleasure, the countervailing shame or embarrassment, and the other. Note that these are very conscious emotions in carefully calibrated conflict. Unlike Daston and Fleck for whom the jizz and making of melody are rather unconscious processes—the mental faculty does not have a clue how it is done—Schaefer's process of knowledge making is a cogent contest of forces, a struggle of different priorities, a constant measuring and remeasuring of the felt weight of facts (Schaefer 2022, 9), the sense of science is a dynamic of multiple intellectual affects held in tension (2002, 34). This aspect of cogency theory again has consequences for the way we conceptualize the thinking-feeling scientist subject. Later in my remarks.

Schaefer then also relates different emotions in—what sounds like agonising agonism—with different forms of knowledge—good knowledge, successful or failed science, true and false science, science on and pulled off track. How scientific rationality is built—how it inculcates confidence or gets impaled by prejudice, how it succeeds or falls?—asks Schaefer. Feeling makes science work, but it also leads to the collapse of good knowledge (Schaefer 2022, 4), we can gain an even better understanding of the sense of science, though, by studying how it malfunctions (2022, 49)—writes Schaefer. My question then is: can we separate prejudice from non-prejudice in individual scientist's subjectivity? And is it possible to neatly relate them with successful or false science, good or bad science?

I have no doubt that Schaefer's intentions here are clear—he wants to show that inducting emotions in the making of knowledge does not make us awry. The most intriguing of all Schaefer's statements—in the flow of reading, I had to read it twice pondering why doesn't it make sense?—"From perspective of cogency theory, good knowledge, too, is made by emotions" (Schaefer 2022, 11). What did he say that good knowledge, too, is made of emotions? In my interpretation Schaefer refers here to how emotions conventionally get bad reputation; how reason and passion are generally arrayed in opposition and related to good and bad science; how we have been made to believe that science is rational because it is not emotional, it is objective because it is not subjective; how emotions are projected as nothing but personal bias that distort objective science; how personal passions and emotions are disruptive, dangerous, childish, feminine, irresponsible, they must be ignored, denied, controlled, relegated to literature and art and biographies, they are not generally the stuff that science is made of. Steven Shapin (2012) calls it a dustbin conception of subjectivity—the bin collects those stories that deflate, disrupt or disorder objectivity. Emotions only distort and make bad science—this is indelibly written of our collective unconscious. Schaefer challenges this mammoth tradition of logical positivism deeply entrenched in our beliefs, institutions, and intuitions about what is good and bad science. He insists how emotions do not distort science, how good knowledge, too, is made by emotions; how collapsing the binary of reason and emotion doesn't leave us adrift. In doing so, however, Schaefer's emotions get separated in pleasure, shame and other emotions, (good, bad, and ugly emotions), which then get connected to good and bad science.

Can we really separate different emotions in the always-emerging subjectivity of an individual scientist at work? Do scientists at work carefully calibrate various emotional responses? In my own book-length exploration of how in the creative struggles of five pioneering scientists, reductionism in the history of genetic science was sustained, adopted, questioned, and challenged—I did not find such conscious, carefully calibrated, agonism of emotions (Shah 2018). Doing science is indeed an emotional struggle—but it happens below the surface of conscious recognition in a way that it is not only impossible to separate emotions for the person experiencing it, but even for an outsider it may need several biographies to excavate those archaeology of emotions and relate them with the process and product of the making of science.

Schaefer himself discusses at length how in his manuscript *Origin Darwin* questions racial differences, while in his book *Descent* he affirms them; how "Darwin's staunch repudiation of anti-Black racism was undercut by his own embrace of cultural racism"; how Darwin never used the word white or Anglo-Saxon, but he wrote about finer gradations of intellectual and moral character of highest races and lowest savages (Schaefer 2022, 151). Not only that it has

taken several biographies to make these internal contradictions visible and still they can't be so neatly related to good or bad science.

Schaefer discusses philosopher Imani Perry's work on how racism is shaped by visceral responses that operate within the process of reason, how racist logic feels right, how it operates outside the conscious awareness of being inadequate and intentional. My own interpretation of Perry's work would be how racist thought is felt right in the body of the person thinking feeling it. Meaning, thinking as feeling when viscerally experienced, it feels right from the perspective of the one who is experiencing it. So from the perspective of the person producing knowledge, there are no prejudices then. There are no other emotions that may contaminate, mess with, slosh around.

By especially invoking the category of other emotions and its relation to bad or false or failed or pulled off track science, or with other forms of problematic knowledge like conspiracy theories or racialized reason, Schaefer is trying to maintain a moral hygiene by, paradoxically, rationally classifying emotions in different categories—there are intellectual emotions on two extremes and in between there are other emotions. This framing exactly prevents Schaefer to pull the bow-string to the point of breaking. It's a love affair but not yet love. Because it is not possible to maintain such conscious and careful emotional hygiene in the making of any scientist's or knowledge-seeker's subjectivity. For the person experiencing thinking as feeling, it is a muddle. Embodied experiences of emotions manifest as muddling through, a chaos, all kind of emotions enmeshed beyond conscious recognition. That is why it is terrifying, by making thinking as feeling we open the can of whole worms. If we open the can, we cannot let the heads walk in and tails be separated and left behind. Can we? My own question then is to inquire—who is the thinking feeling scientist-subject? In my own book-length exploration of scientist-subject, I see knowledge-seeker as a self that is not only a fundamentally feeling, suffering, experiencing affective self but most importantly, this self is incoherent, contradictory, heterogeneous, split between the conscious and unconscious, both fictional and real at the same time, the self that comes into being only in relation to others. I have argued how this affective self is profoundly constitutive of the method and philosophy of science, but it goes both ways—making choices in science also means choosing the affective mode of existence. My claim is that intellectual paradigms are affect worlds, in other words, the conceptual theories are isomorphic with the world emotionally and existentially desired (Shah 2018).

I now want to reflect on the way Schaefer separates good and bad science/knowledge/logic. He interprets Perry's work on racism as visceral response that operates within the process of reason, how for the person experiencing it, racist logic feels right. Schaefer also elsewhere in his book discusses at length how racialized reason are created by feelings. Rather than a set of propositional claims about who's up and who's down, racism is sunk deep into the bodies of

both its agents and its victims, Schaefer writes (2022, 24). However, despite this clarification, Schaefer interprets Perry's argument to claim how these visceral responses in intimate connection with emotional machinery of scientific knowledge production threatens to pull science off course (Schaefer 2022, 8). What would science being on and off course mean here? Schaefer writes that affects are the pulse of reason. This is both why science succeeds and why it fails (21). But then Schaefer writes that click can also totally derail the search for truth, licensing our prejudices as what feels true, sanctifying what we think we know and rendering it immune to challenge (24). We can gain an even better understanding of sense of science, though, by studying how it malfunctions (49). (All emphasis in quotations mine). There are thus various connotations of science—good and bad science, science gone off course, science that succeeds or fails, prejudices derailing search for truth, other intellectual emotions messing up our thinking, science that malfunctions.

“Can there be feminist science?”, asks feminist epistemologist Helen Longino and answers it in the negative (Longino 2001). In principle it is possible to do science as a feminist, but there is no feminist science, says Longino. This is an old debate among feminist epistemologists in science studies, somewhat done and dusted (Shah 2013), but I want to rehearse some of the main points of this debate in relation to these different connotations of science appearing throughout Schaefer's book, to remark on what is understood as science and how may thinking as feeling alter it.

Following the publication of Keller's biography of McClintock in 1983 a debate started on whether there was distinctly feminine or even feminist science. According to the much-debated storyline, for Evelyn Fox Keller, McClintock was an exceptional scientist devoted to a holistic conception of life, whose science of maize genetics was sensitive, dynamic, interactive, and flexible, inspired by her “feeling for the organism” (Keller 1983). Keller's biography highlighted the role of intuition, feeling, connectedness, relatedness—the qualities that are stereotypically identified as feminine—in the making of McClintock's science. Although, the key part of Keller's story of McClintock's life was an account of how McClintock's unorthodox scientific views challenged the gene as master-molecule dogma of the time and how they isolated her from the mainstream science (Keller 1983). But many understood Keller's story of McClintock as demonstrating how women saw scientific objects with feelings and hence their science was holistic and hence radically different from the reductionism of male-dominated science. Keller's account eventually made McClintock a feminist icon with which started a debate if stereotypically feminine gender traits have role to play in transformation of mainstream science—which otherwise displays stereotypical masculine gender traits, and if the feminine traits could make science more humane and more in tune with nature (Keller 1987; Richards and Schuster 1989). The same question was also

posed differently: Do women indeed do science differently than men? If so, could there be distinctly feminine method? In these propositions were confused and conflated feminine with feminist, science as content and practice, science as product and process, science as epistemological methodological entity and its political cultural context, constitutive values internal to science and contextual values external to science. What is science after all?

In the history and philosophy of especially natural science, since the French philosopher Gaston Bachelard, methodological or epistemological field of science is understood to consist of a set of interlinked, mathematicized concepts which intra-act with instrumentalities or experimental hardware to form what Bachelard called *phenomeno-technique*. Many women scientists doing hard science were angry with the suggestion of distinctly feminine science because such science was then branded as soft science—as non-mathematical science. They felt that in the name of better science, they were asked to do inferior science, not-even-science. Another way of saying women can't do science. Taking this argument back to where it all started—Keller's biography of McClintock—Nathaniel Comfort (2011) did second biography of McClintock two decades after Keller's biography, in which he called Keller's story of McClintock as being rejected, ignored, not listened to, ridiculed by the mainstream male-dominated scientific community, a myth. Comfort says that McClintock herself created this myth which Keller took it at face value. Comfort then spends entire biography to separate fact from fiction, to dismantle the McClintock myth. I have written an entire chapter and a paper on reading Keller and Comfort's biographies together to have my own analysis of McClintock's subjectivity and her relation to scientific objects, and I do not intend to repeat my arguments here (Shah 2018, chapter 5; 2016), but what I want to highlight here is that Comfort repeatedly shows in his biography that McClintock's theories were rejected, not listened to, ignored by the wider scientific peers not because she was a woman or that she had a holistic views of her scientific objects that challenged the male-dominated dogma, but because her arguments were speculative, because she did not have adequate data to substantiate them. McClintock' science was bunch of ideas, empirically it was not-yet-science (Comfort 2001). Long story short, methodologically and epistemologically, especially when we are speaking of hard or physical sciences, there cannot be good or bad science—there is science or none-science. Science as moral or political category is then only a product. Science that built atom-bomb is always science, what it did to Hiroshima and Nagasaki is morally and politically bad science.

There are three distinct connotations of science in the play here: methodological or epistemological, political or moral, and cultural or historical. science and technology studies have spent considerable amount of ink and paper to show how they overlap or interact. How to open the black box of science and to show how it is historically, culturally, politically, morally constructed is the

mainstay of much of science and technology studies. The point is when societal impact of science can be easily categorized morally or politically as good or bad or ugly—methodologically and epistemologically, there is only science, in other words, there is either science or no-science, science that works and science that does not—successful and failed science, perhaps yes, but good and bad science, no. The pendulum of the mind alternates between sense and nonsense and not between right and wrong—said Carl Jung. So then science as sense-making the good science is what makes sense and bad science as nonsense science or no-science.

I know that my commentary here is partial to natural or hard science. What about social sciences or humanities? And I must admit that in writing this commentary I had days of agonizing agonism—I felt a knot in my stomach imagining all forms of knowledge conflated together in Schaefer's book. Schaefer clarifies that knowledge and knowledge-making is a master term that applies to formalized knowledge like math, science, history, philosophy, humanities, and all other forms of non-formalized knowledge like informal everyday knowledge about the world like a group text, or a reddit thread, or the incident of people-watching at café (Schaefer 2022, 4), at another place Schaefer treats all forms of knowledge produced in a chemistry laboratory, a noisy pub, an operating room, or a wheat field, *on par* (2022, 55). The chapters on conspiracy theory and racialized reason refer to various formalized and non-formalized knowledge-sources such as reddit thread, emails, pamphlets. I felt concerned about treating formalized science and everyday forms of knowledge within one frame. Is there a way to distinguish cultural prejudice expressed in a public or private space from institutionalized science driven by prejudice? I was paralyzed for days writing this commentary pondering upon this point. Something quite does not feel right, what is it?

In my comments for the 4S panel at the Honolulu conference (authors meets critics debating Schaefer's book), commenting exactly on this point when I described myself as an old-fashioned Popperian, all my fellow panelists' heads turned, and there was much discussion on how science cannot be so neatly separated from other forms of knowledge and how there is a continuum in the way formalized and non-formalized knowledge unfold and bleed into each other. Yes, I agree—rationally. And then, I feel uncanny. As a feminist this unease rises deep inside my stomach as a feeling of insecurity about mixing science with other forms of knowledge. I believe that institutional forms of science acquires its authority and legitimacy from its method, its verifiability and replicability (yes, by applying Popperian falsification principle), its aspiration for truth and objectivity—while I use each of these terms very carefully qualifying that their meanings and how they manifest in a particular scientific case in a particular historical context are highly contested, they still constitute the bedrock of scientific institutions which then allow the possibility that science

can be systematically contested, challenged and reformed, it can be called on to be responsible and accountable. Because I believe in power of ideas to change the world—and this is why I work within the university—to debate, engage with, contest, teach, research scientific ideas. Cultural prejudices of a group of people watching a soccer game at a café or a thinking as feeling expressed in a reddit thread cannot be so systematically challenged, made accountable, responsible. Without this distinction of science and non-science, I fear that all knowledge may collapse into merely opinions—personal or collective, does not matter. This is precisely the reason why historians of science are wary of inducting feelings into making of science—what Keller was referring to. This is why I interpret that Schaefer gets onto a defensive backfoot about other emotions and their relation with bad science. I want to maintain a boundary in understanding how thinking feels applies radically differently in the making of different knowledge categories. And my commentary refers to only hard sciences deriving from my own work on history of genetic science.

For me, the pertinent questions to ask are: What is science and how it is made by emotions? How does the psychic life of the scientist-subject relate to the mode of science and how do practices of science constitute emotional subjectivity? How do agonism of feelings shape internal content of science, what Longino calls constitutive values, epistemological (truth-seeking) part of science? How do we open the black box of science and show how agonism of emotions are not external forces or products of science-making but how they are incorporated in the method, in the choice of hypothesis, in the choice of value-based assumptions forming theories, in the production and analysis of empirical results, in the making of theory? How do the affective is not only the motivational force or the end result of doing science but profoundly constitutive of the making of the science itself? How can we unpack science on case by case basis to show how embodied emotions are incorporated in its making, so that they can be made visible opening up a possibility to challenge them if necessary?

In conclusion, it has been a pleasure to read and engage with Schaefer's book. I cannot have enough. I hope this is a provocation enough for Schaefer to start thinking feeling next book because then he already has a dedicated reader anxiously and joyously waiting to read it.

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