

On Cultivating an Attitude of Precision with Language: An Uncommon Prescription for Conditioning Creative Excellence in Scientific Discovery and Education

David J. Waters

Center for Exceptional Longevity Studies, Gerald P. Murphy Cancer Foundation, West Lafayette, IN, U.S.A.

Abstract

Investing years of intensive training, scientists ready themselves to make sense of the world. *But are they prepared to make sense of a world of words?* The aim of this paper is to explore the pivotal role that cultivating an attitude of precision with language could play in conditioning creative excellence in scientific discovery and education. First, the unexpected linkage between the processes of language precision and successful failure is explored. Next, an attempt is made to situate language precision within the creative process. Then, another potential dividend from developing exactitude with language is explored — the power of neologism. Finally, an attempt is made to construct a useful synthesis — one favoring a new educational prescription in which creative excellence in the sciences is informed and catalysed by the humanities.

Biographical Note

Dr. David J. Waters earned his BS and DVM degree from Cornell University and holds a PhD degree from the University of Minnesota. He is Professor Emeritus of Purdue University and Director of the Center for Exceptional Longevity Studies at The Gerald P. Murphy Cancer Foundation in West Lafayette, Indiana, USA. Trained in the comparative aspects of oncology and biogerontology across different species, he utilises cellular and animal models to gather clues to better understanding critical pathways that promote cancer resistance and healthy longevity in humans. Since 2008, he has led the research team conducting the first systematic study of exceptional longevity in pet dogs. His teaching is focused on interdisciplinary science education at the graduate level with emphasis on: the biology of cancer and aging; more effective and opportunistic writing; and attitudes of personal performance that promote creative excellence and self-renewal. The author of more than 100 peer-reviewed scientific papers, his 2013 TEDx talk [“The Oldest Dogs as Our Greatest Teachers: Get the Words Out of Your Eyes”](#) highlights the innovation of studying the oldest-old pet dogs and underscores how our use of language limits scientific discovery and impacts how we respond to new ideas.

Keywords

Creative Writing – Creativity – Science education – Interdisciplinary – Neologism – Failure

Introduction

Over the course of nearly three decades engaged in scientific discovery and education, my attention has been drawn to exploring ways in which discoverers and educators can optimise their performance. Increasingly, I find myself advocating for a non-technocentric view of scientific progress — cultivating in each of us the capacity to perform at the highest level, rather than waiting for the next technological breakthrough to catapult our leap. My urge to achieve creative excellence is inspired by Ermanno Bencivenga's notion:

Let us have a few individuals train for what is *not* at hand, and perhaps *never will* be at hand, but *could* be at hand ... a small group of revolutionaries will have to be slowly and patiently trained to undo all training, to practice taking practices apart, to tell and write what now cannot even be imagined, and thus draw anew the confines of imagination. (Bencivenga 1990: 79-80)

However, first-hand experience working in the health sciences has led me to diagnose a hidden deficiency. Innovation in healthcare — whether we are talking about discovery, education, or delivery — hinges upon language. *Yet, students and faculty in health sciences are inadequately trained in precision with language.* Training in language precision seems to be reserved for those who would become poets, historians, or politicians — not scientists or health professionals. Cultivating an attitude of precision with language could elevate the creative performance of health scientists, providing a necessary counterbalance to the prevailing technocentric view of medical ascendancy. To achieve progress, there is no doubt we need 'tech readiness'. But we also need what I would call 'linguistic readiness'. By *linguistic readiness*, I have in mind attaining a capacity for language precision and developing the ability to listen with the intent of real change (Figure 1)[1].

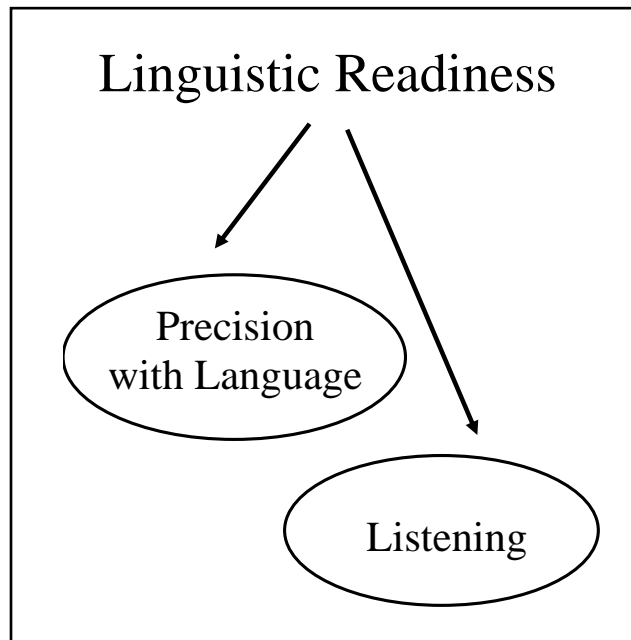


Figure 1. The two components of linguistic readiness.

It seems a bit puzzling that I should feel the need to defend an idea that sounds so self-evident. Clearly, language is the gateway to discovery because language shapes not only how we communicate, but how we think [2]. Words are our starting points — for our present practice, our thinking, our future inquiry. The general semanticist Wendell Johnson put it this way: ‘We see through our categories’ (Johnson 1956: 102). Categories are words. For you, is the world flat or round? Are ovaries just reproductive units or are they endocrine organs capable of producing hormones, which exert system-wide effects that impact health and disease? Is there one type or 15 types of leukemia? Our progress will reflect our starting points. For example, if you are trained that leukemia is one disease, you are probably not very well positioned to discover another form of leukemia. But if you see leukemia as 15 different diseases, you're all set to discover that 16th variety. Your discovery path is motivated by the mantra: What's magical about 15? So let us agree that we are the products (victims?) of our training, imprisoned by the words currently in our heads [3]. William James, the grandfather of modern psychology, framed it this way: ‘The greatest enemy of any one of our truths may be the rest of our truths’ (James 1968: 389).

In response to these introductory remarks, it might be asked: What makes the practice of language precision more important to practitioners of science than to scholars from other disciplines? My reply would be: Nothing. To be clear, I am not presupposing here that an attitude of precision with language is peculiarly important to scientists. Rather, the case I am trying to make is that the scientific method is a method limited by language. Such a claim regarding the primacy of language to method may seem intuitive to individuals operating in the humanities, for whom an awareness of the effects of language is situated at the core of nearly every debate, each scholarly advance. But I contend that this state of affairs is not the norm among practitioners of science. Scientists are simply not trained to think that way about language. My purpose then is to explore the linkage between language precision and creative excellence within my own professional context — the state-of-the-art training of scientists — in which I perceive a critical deficiency is dwelling. And although the cultivation of language precision is expounded upon here as an uncommon prescription for scientific advance, it is intended that the value of the ideas presented here on creative excellence in discovery and dissemination will be transferrable to readers who see themselves operating outside the scientific realm.

To begin, let us consider the relationship between language and discovery. When it comes to the act of discovering, language is never simply a relating of how a discovery was made. *Language is part of what is discovered — shaping the knowledge content of each experience.* For example, if you see a thing in a tree and name it ‘robin’, you stop looking at it closely; and it is not likely you will make any further discoveries about that particular bird. Through the act of naming, you have ‘fixed’ that object and the resultant knowledge content of that encounter. Clearly or not, we see the world through our categories. Therefore, the *perceptual acumen* [4] we hope to attain might be described as the mastery of categories. But there is something potentially problematic about this description: *Our category-driven Self-knowledge is scripted by someone else's words.* We rely upon somebody else's language — words deposited during our training, words we have borrowed — to describe our unique situations and our process of navigating those circumstances. This makes little sense if we are truly trailblazing where few others have dared to venture. If we were to engage in a process of becoming

neologicistic discoverers — fluent in formulating new words — would we not be better positioned to create new starting points that would favour surer advance?

Before outlining particular ideas that will be explored in this paper, it is worth making some general statements intended to make plain the range of meanings expressed by the terms ‘language precision’ and ‘creative excellence’. By ‘language precision’ is meant a capacity for formulating word constructions that contribute to meaning-making by minimising misrepresentation and that enhance communication by avoiding oversimplification or distortion. This capacity is realised through developing one’s relationship with words and by heightening one’s awareness of the relationship between words and the ‘things’ they represent. By referring to cultivating language precision as an ‘attitude’, it is suggested that language precision is not an inflexible tool but rather a habit of mind, a tendency-to-action that is situationally sensitive. Like all tendencies-to-action, an attitude of precision with language is viewed then not as a destination but rather a striving — a striving for a process of meaning conveyance rooted in a responsiveness to: levels of abstracting and generality; contextual contingency; and nuanced category usage. Developing an attitude of language precision is an act of repertoire-building, which enables refined representation and expression by promoting a willingness to linger longer in pursuit of finding ‘the right word’. Attitudes constitute Self, and therefore those who exercise this attitude see language precision as an essential part of their own meaning-making apparatus — not only in orchestrating rare imaginative leaps but also directing the day-to-day creation and re-creation of one’s sense of Self and Other.

By ‘creative excellence’ is meant a state of performance characterised by original work and the making of new things that exceeds a threshold of usefulness. Across many different domains of practice and inquiry, creative excellence is enabled by an underlying capacity to see beyond conventional patterns and interpretations to achieve what has not been done before. The products of creative excellence include not only discoveries but new methods of discovery, communications in the form of verbal or written expression along with novel methods of expression. ‘Excellence’ implies there is a brilliance or distinction to these acts and/or their products. Acts of creative excellence have both destructive and synthetic features — a process characterized by the dismantling of old (current) ideas followed by reconstructing them anew. The progress or advance that accompanies creative excellence is not limited to external products, but also includes the shaping and re-shaping of Self, so that the possibility of deeper discovery of Other comes within closer reach. Creative excellence implies situational excellence, which is foundational to both iconoclastic feats of the extraordinary as well as slower, yet meaningful advances (‘baby-steps’). Because of the combinatorial nature of the creative process, a state of creative excellence is expected to be enhanced in individuals who bring multiple and varied angles of vision to their problems, tapping into both imaginative and analytical capacities.

I will not offer here specific arguments against particular methods of scientific training, but instead offer a depiction of what I believe are the aspirations and intentions of those responsible for shaping conditions of learning. For if these intentions align with a view that holds language precision as an essential asset central to the process of achieving creative excellence in the sciences, then we will have taken an important step toward conceptualising a new educational prescription. Today, teachers in the classrooms of interdisciplinary science education are faced with the challenge of implementing an ambitious goal: *To cultivate tomorrow’s imagino-analytical leaders*. Not just masters of analytical problem solving, but skilled navigators steeped

in imaginative reasoning. It sounds simple enough, but inevitably obstacles will be encountered along the way. Students will be striving to achieve *situational excellence* — not just excellence in general, but excellence in particular and varied situations. But their greatest achievements will hinge upon their failures — *it will be their willingness to fail and their ability to fail successfully that will enable them to reach their highest creative potential*. At the same time, they will be striving for an *inner eloquence* — crafting with utmost precision the language they use inside their heads to shape their best ideas. With this set of aspirations in view, it is tempting to speculate that only a sorely inadequate synergy between sciences and humanities education [5] could explain why the method of preparing scientists has so often overlooked the critical importance of training in language precision.

In this paper, I will be exploring the pivotal role that acquisition of language precision could play in conditioning creative excellence in scientific discovery and education. First, an unexpected linkage between the processes of language precision and successful failure is presented, showing that by embracing an attitude of language precision it is possible to garner a cascade of attitudes that can be instrumental to personal growth and elevate creative achievement. Next, an attempt is made to situate language precision within the creative process, specifically as a source of constraint which can promote creative work and guide the calibration of what the French mathematician Henri Poincaré called a ‘delicate sieve’. Then, I probe another potential payoff that cultivating an attitude of exactitude with language brings — a proclivity for *neologism*, the introducing of new words. Next, three examples from medical science research are used to illustrate the consequence of language laxity that I have coined ‘naïve substitution’. Finally, after exposing a potential obstacle to achieving the goal of language precision, an attempt is made to construct a useful synthesis that invites a new educational prescription, one in which creative excellence in the sciences is catalysed by the humanities.

2. The Failure Hinge: Unexpected linkage between language precision and successful failure

Could precision with language be the key to reaching one’s full creative potential? I believe the importance of language to performance, which is no less than pivotal, can be expressed this way: *The gift we receive from language precision is an increased capacity to make achievements of distinction – a greatness that hinges on failure*. This idea is conceptualised in what I refer to as *The Failure Hinge* — the discovery of an unexpected linkage between language precision and failing successfully. When it comes to how we use language, we have two choices: exactitude or inexactitude. The Failure Hinge, illustrated in Figure 2, depicts the rewarding cascade of attitudes that can be triggered by language exactitude. Let us examine it in closer detail.

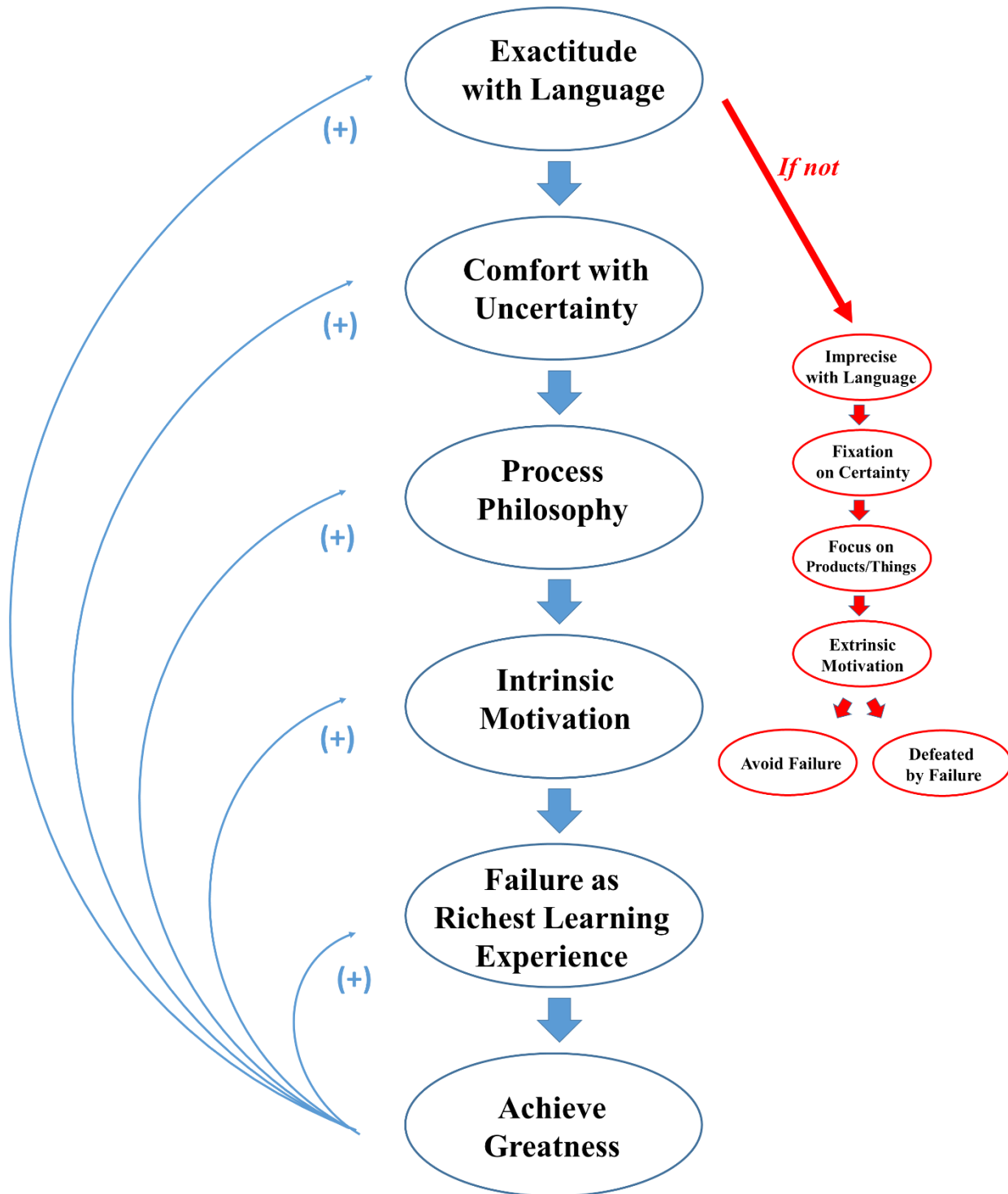
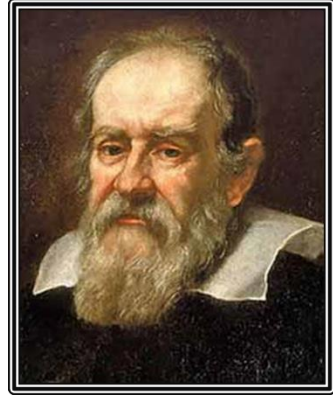


Figure 2. The Failure Hinge.

When we choose to exercise exactitude with language, a paradox is immediately revealed: *The more exactitude with language we exert, the more we come to see that everything is uncertain.* Uncertainty prevails. Each of us has experienced this in our daily lives — the deeper you look into something, the less sure about things you become. History tells us that Galileo (Figure 3) experienced this paradox [6]. Galileo was receiving flack from his contemporaries, pressuring him to comment about his extensive knowledge of comets. Galileo was reluctant to say much, stating that it was because he had studied comets so carefully that he had so little to say about them.



In *The Assayer* (1623) he wrote:

Figure 3. Galileo Galilei (1564 – 1642). Galileo understood that distance breeds false certainty. ('Portrait of Galileo Galilei' by Justus Susterman is licensed under PD-art.)

Long experience has taught me this about the status of mankind with regard to matters requiring thought: The less people know and understand about them, the more positively they attempt to argue concerning them, while on the other hand to know and understand a multitude of things renders men cautious in passing judgment upon anything new. (Galileo 1957: 256)

Distance breeds false certainty. And this calming sense of certainty — the comfortable, but illusory, product of distance — stands in stark contrast to the discomfort most people feel about functioning amid uncertainty. *Exactitude with language positions us to develop comfort with uncertainty.* Michael Gelb (1998) has used the term 'sfumato', which is Italian for 'up in smoke', to refer to the attitude of being comfortable with uncertainty and paradox. Not only does exactitude with language usher forth an awareness of uncertainty, it prepares us to more skillfully decipher the swirling possibilities. This is critical for creative advance because, as noted by Alfred North Whitehead, 'there are no clear divisions when you push your observations beyond the presuppositions on which they rest' (Whitehead 1966: 15). It is uncertainty, not certainty, that fuels creative work. As Brewster Ghiselin points out, creation is always 'an assault upon fixation, an escape fueled by a desire for an order that does not exist' (1966: 362).

As one's comfort with uncertainty grows, one naturally gravitates toward a *process philosophy*. A philosophy of process means that change is an essential part of reality's flow (Whitehead 1966). You see yourself as unfinished and see other persons and events around you as processes, not things. Our instinct is to prefer to interpret objects as *things*, when often they are ever-changing *processes*. Too much time is spent on contemplating 'what is the thing', too little time spent on relations. For example, take cancer. Is cancer a thing? Not really. It is not an invader, like a bacterium or a parasite. Instead cancer is a *process* gone awry. And as members of the human species, each of us is engaged in this process of *cancering* (Agus 2012)[7]. Perhaps by simply seeing cancer as a process rather than a thing, we might gain fresh insights into how to control cancer. We might re-direct our efforts toward re-regulating this process, rather than attempting to eradicate every cancer cell using toxic chemotherapeutic drugs, an approach which has not delivered the breakthrough results that scientists have been looking for.

One can find this primacy of process solidly reinforced in the poetry of Wallace Stevens (Figure 4). In his poem ‘The Man on the Dump’, Stevens creates a striking image — a poet sitting amid a pile of his own images and descriptions which have become irrelevant (Stevens 1964: 201-03). Every scientist must come to realise that his brilliant new idea, revered today, will someday be thrown on the scrapheap of worn-out ideas. But lying there discarded, will his idea be recognised for its intrinsic beauty, its value as a stepping stone to a richer understanding? The answer to this question will be a resounding ‘yes’ if the idea has moved others to ask and then answer a richer set of questions, if it has ignited a spark. ‘The Man on the Dump’ teaches us to temper what Stevens called the ‘blessed rage for order’ with a counterbalancing energy that embraces flux and seeks to avoid fixation [8]. We should celebrate those attempts that advance our understanding of Nature, as we come to witness our own potentialities. In doing so, we will cultivate a crop of young scientists who will come to deny, rather than envy, the so-called ‘definitive study’. For research is a process, not a thing. And therefore any newly ordered reality is quickly subject to re-ordering — becoming a mere mental remnant of a relentless march called the discovery process.



Figure 4. Wallace Stevens (1879 – 1955). In his poetry, Stevens expressed the challenge of making sense of a world of words. Image Source: Wallace Stevens Papers, The Huntington Library, San Marino, California.

A philosophy of process readily fosters an attitude of *intrinsic motivation* — joy is found primarily in the process, rather than the product. Intrinsic motivation [9] refers to the desire to engage in an activity for its own sake (Kohn 1993: 270). Doing becomes the reward. This attitude bolsters the intensity so critical for creative work [10], so essential for the continuation of work that can only deliver sporadic payoffs, which I refer to as ‘lumpy rewards’. You feel inspired; ‘I’m living my dream’. You find yourself in what Mihaly Csikszentmihalyi terms *autotelic experience*, or *flow*: ‘When experience is intrinsically rewarding life is justified in the present, instead of being held hostage to a hypothetical future gain’ (1990: 69).

And the payoff continues. Being in a state of intrinsic motivation delivers something very important: *We learn to see failure as our richest learning experience*. This is in vivid contrast

to extrinsically motivated persons, for which failure often proves devastating. And finally, if we can see failure as our richest learning experience, then we can achieve greatness (Maxwell 2000; Ottman 2004). By accepting the certitude of failure, we grow to see failure as the engine of the extraordinary. Creative failures become stepping-stones, not obstacles, to meaningful advance. Becoming open to the notion that failure is an essential part of our meaning-making process, we accept failure more willingly, acquiring the habit of failing successfully.

Before leaving this triadic relationship between language precision, failure, and creative advance, a few qualifying statements seem appropriate. Neither the diagram nor description of The Failure Hinge are intended to give the erroneous impression that language precision drives an unalterable, lock-step progression to further attitude attainment. Instead, linkages depicted within The Failure Hinge framework indicate that exactitude with language is a potential influence upon any receptive person's capacity to adopt an attitude of comfort with uncertainty, which can lead to further dividends. Acquisition of language exactitude does not guarantee that each individual will reach an absolute comfort with all forms or degrees of uncertainty. Rather, it should be seen as a potentially important trigger for developing an increased comfort with uncertainty, which can promote a *readiness* for attaining other key attitudes [11]. Further, it is assumed that many other cascades could be constructed to illustrate the role of other factors that favor creative achievement. The Failure Hinge represents *a* path, not *the* path, to creative excellence. Finally, like the technique used for examining the validity of a reaction sequence in organic chemistry, one might find it more satisfying to ponder The Failure Hinge by working *up the page*, i.e. in the reverse direction. For example, what influences might move us to fail more successfully? The cultivation of intrinsic motivation. How might we strengthen our intrinsic motivation? Embrace a philosophy of process.

To summarise this section, The Failure Hinge shows that to those who cultivate an attitude of exactitude with language is availed an impressive cascade of attitudes — comfort with uncertainty, process philosophy, intrinsic motivation, and seeing failure as one's richest learning tool — all of which can become instrumental to personal growth and creative achievement. If this attitudinal elixir could be packaged in a pill, wouldn't scores of people be clamoring for this prescription — *a prescription labelled language precision?*

3. Creativity and constraint: Calibrating Poincaré's delicate sieve

We have just explored the cascade of attitudes leading to successful failure and creative advance that can be conditioned by developing precision with language. Now let us turn our attention to the creative process as envisioned by Poincaré, and consider the possibility of extending Poincaré's schema to include a decisive role for language precision. 'Delicate sieve' is a term first introduced to the study of creativity by Henri Poincaré (Figure 5). Poincaré was particularly keen to understand the nuances of the creative process, especially as it related to mathematical discovery.



Figure 5. Henri Poincaré (1854 - 1912). Poincaré envisioned creativity to be the product of a delicate sieve. ('Henri Poincare' is licensed under PD-old.)

In his 1908 book titled *Science and Method*, he described his experience attempting to work out a mathematical problem. He was struggling, stuck without a satisfying solution, and had put his problem aside when he wrote:

Thereupon I left for Mont-Valerian, where I had to serve my time in the army, and so my mind was pre-occupied with very different matters. One day, as I was crossing the street, the solution of the difficulty which had brought me to a standstill came to me at once. I did not try to fathom it immediately, and it was only after my service was finished that I returned to the question. I had all the elements, and had only to assemble and arrange them. Accordingly, I composed my definitive treatise at a single sitting and without any difficulty. (Poincaré 2003: 54-55)

The dilemma for Poincaré — for all of us — boils down to this: *Is creativity a product of calculated work or spontaneous enlightenment?* After careful consideration, Poincaré concluded that creative accomplishment required both — intentional effort and spontaneous illumination.

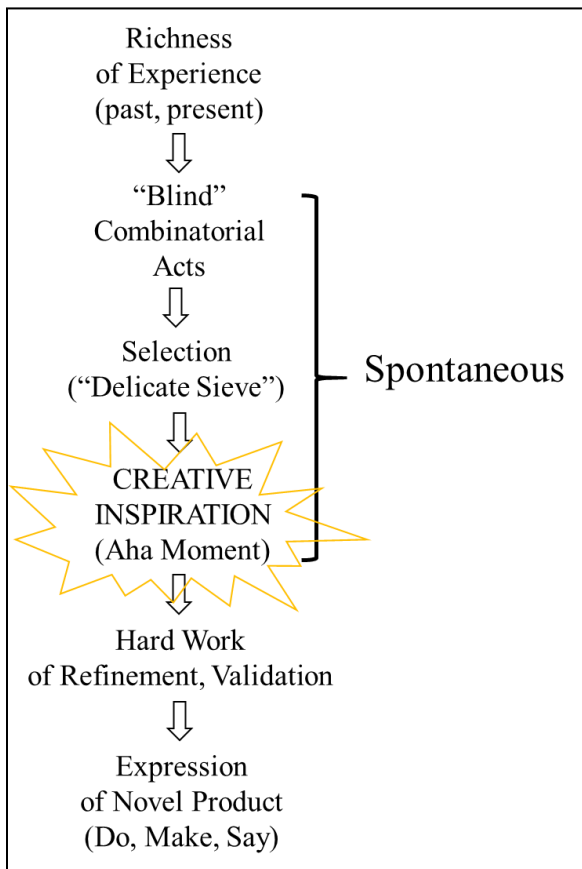


Figure 6 attempts to capture the salient steps in Poincaré’s envisioning of the creative process. First, a rich array of past and present experiences are accumulated through hard work. Next, there is a spontaneous internal phase, composed of ‘blind’ combinatorial acts (ideas bumping into ideas) followed by selection, leading to a creative breakthrough — the so-called ‘aha moment’. Later a second phase of hard work is required to refine and validate the products of this spontaneous part of the creative process. Creativity is combinatorial, which explains in part the circumstances that favor the capacity for generating a creative response. If you have two lonely ideas in your head, there is not much opportunity to generate fruitful collisions. But by holding in mind a vast number of varied experiences and ideas, thousands of combinations are possible. Poincaré needed to explain how only a privileged few among the plethora of possible combinations eventually bubble up into one’s consciousness. He reasoned that a selection device was needed to single out the breathtaking new idea that would emerge as winner, and wrote:

Figure 6. The creative process modeled after Poincaré.

The combinations so obtained would be extremely numerous, useless, and encumbering. The real work of the discoverer consists in choosing between these combinations with a view to eliminating those that are useless, or rather not giving himself the trouble of making them at all. The rules which must guide this choice are extremely subtle and delicate ... Under these conditions, how can we imagine a sieve capable of applying them mechanically? (Poincaré 2003: 57)

Eventually, Poincaré would conclude that it is one’s aesthetic sensibility that functions as the delicate sieve. The combinations that cross the threshold of conscious activity do so by a delicate intuition.

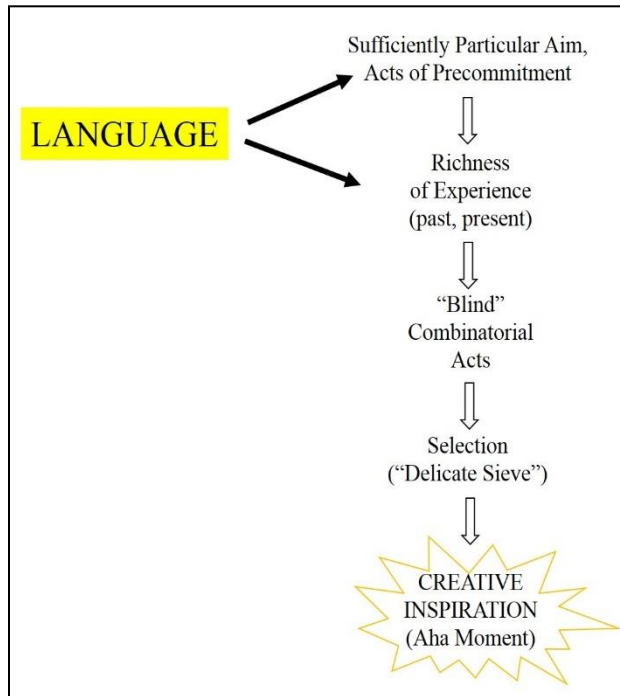


Figure 7. Language plays a decisive role in the creative process.

So far, so good. But something is missing. It is the critical trigger that initiates the steps of the creative process depicted in Figure 6. And here, I propose that an attitude of precision with language provides the necessary constraint so that one can achieve the most potent trigger — *an aim that is sufficiently particular* (Figure 7). For it is a sufficiently particular aim that guides the direction of the intensely focused information gathering and expansive thinking that comprises the first phase of hard work. Moreover, it follows that the language precision used to formulate the worker’s particular aim and his *acts of precommitment* within the situation of interest would impact which ideas bubble up out of the soup of spontaneous combinations [12]. Early constraint — closing doors and limiting options rather than just ‘thinking outside the box’— is paramount (Stokes 2006; Livingston 2009) [13]. Using the metaphor of Poincaré, *language precision*

calibrates the delicate sieve — elevating the possibility that the breathtaking solution that bubbles up is in synchrony with your particular aim. As a result of this working order, the creative worker focused on the health consequences of vitamin E is never greeted in his ‘aha moment’ by an innovation for the building of a treehouse or the arranging of flowers.

It follows from this re-considering of Poincaré’s model that there is no universal sieve possessed by everyone, nor is there a single sieve that any single person is inclined to use in a variety of situations. The words used to represent one’s particular aim and shape one’s acts of precommitment furnish the necessary constraint — the constraint that drives forward the creative process, promoting situational excellence and the intensity of the encounter [14]. It won’t do to say, ‘I’m going to be creative today. And what’s on my mind is vitamin E’. Instead, today’s creative process is catalysed by constraining the context of the aim to something like this: ‘What are the potential interactions between vitamin E and exercise that might adversely impact health?’.

4. Necessity obliges us to neologize

If we train ourselves in unique ways and if we engage ourselves in pursuing never-before-pursued questions, it will be useful for us to consider the power of *neologism* — the formulation of new words. New words become new tools. The necessity of creating new words could be articulated this way: ‘The new circumstances under which we are placed call

for new words, new phrases, and for the transfer of old words to new objects ... *necessity obliges us to neologize*'. These are not my words. This statement was written more than 200 years ago by Thomas Jefferson (1884:185, 189; emphasis added), the person credited with the first use of the term 'neologize'.

Part of the power of neologism is that it reflects *ownership* — it marks that the worker has thought deeply about the issue at hand [15]. For example, my research group has conducted in-depth studies of the essential trace mineral selenium as a potential cancer prevention agent. Conventional wisdom says that selenium protects cells against genetic damage because it is a component of the enzyme glutathione peroxidase, one of our most powerful antioxidant defenses. But after looking carefully at all of the data published by experts in this field, it was clear to us that selenium's role in cellular protection could not entirely explain its cancer-fighting properties. Our research discovered a new mechanism of how selenium works based upon studies in dogs and in cell culture: *Selenium allows your body to selectively sweep away the most damaged cells*. We had discovered a new mechanism, and so we needed new words. Our neologism was 'homeostatic housecleaning' — the ability to selectively sweep away the most damaged cells. And in the spirit of Thomas Jefferson, we introduced *homeostatic housecleaning* into the scientific literature in a manuscript published four years ago (Chiang et al 2013).

And when our work on the factors that regulate longevity in pet dogs and in people discovered that keeping ovaries longer was associated with living longer (Parker et al 2009; Waters et al 2009), we needed new language. We introduced the term 'ovarian ecology' to represent and communicate the idea that ovaries are part of a system that regulates longevity. Just as removing the caterpillars from an ecosystem changes that system in many and often unforeseen ways, so it is we believe that removing ovaries disrupts the *ovarian ecology* of women.

But creative excellence does not just require using new words. It also requires getting old words out of the way. This was the subject of my 2013 TEDx talk titled: 'The Oldest Dogs as Our Greatest Teachers: Get the Words Out of Your Eyes' [16]. One of the words that members of my research group have stopped using is the word 'know'. We stopped using 'know' because it is too frequently misinterpreted as implying certainty. Too often then, the word 'know' serves as a stop sign for further inquiry [17]. This false sense of certainty can deflect our creative energies away from research questions that deserve penetration. When it comes to optimising health, I am growing less convinced that we 'know' very much. In fact, even the most revered scientific manuscript can be seen as merely *a view formed under special circumstances* (Waters 2012). For example, in 2009, Ristow and colleagues published a scientific manuscript on the ability of dietary antioxidant supplements to block the beneficial effects of exercise. The paper was titled: 'Antioxidants Prevent Health-Promoting Effects of Physical Exercise in Humans'. But the manuscript could just as easily have been titled: 'A View Formed Under Special Circumstances'. Why not? The authors chose the study population, the dose of antioxidants, the intensity of exercise, and the study endpoints (Ristow et al 2009). The neologism we coined to help us articulate this idea is 'viewfusc' — a view formed under special circumstances [18].

Armed with an awareness that all observations, generated by Self or by others, are more fruitfully approached as a *viewfusc* rather than as Truth with a capital T, we are afforded a powerful anti-dogma device. It sends an internal signal to keep digging, rather than lay aside our tools of discovery. To make surer progress, each of us should consider which words

in our domain need to be removed from the current, conventional vocabulary. Extending the commonsense method asserted by Jefferson, I suggest that ‘*Necessity obliges us to decidologize*’ — to cut out words [decidere (Latin) = to cut off]. If language is indeed the gateway to discovery, it is no surprise that both the *art of neologism* and the *art of decidologism* belong in the toolbox of the creative.

5. Science as method: Can we avoid naïve substitution?

Too often science has been taught as a subject matter — a collection of facts — rather than a method of inquiry we use to make sense of the world. This predicament was addressed more than 100 years ago by John Dewey (Figure 8) in a speech delivered to the American Association for the Advancement of Science:

I mean that science has been taught too much as an accumulation of ready-made material with which students are to be made familiar, not enough as a method of thinking, an attitude of mind, after the pattern of which mental habits are to be transformed. (Dewey 1910: 122)

It is the illumination of method rather than the claim of a superior significance of facts that should be instilled in our students. Dewey continues,

the future of our civilization depends upon the widening spread and deepening hold of the scientific habit of mind; and that the problem of problems in our education is therefore to discover how to mature and make effective this scientific habit. (Dewey 1910: 127)

I contend that Dewey’s call for seeing science as method does not go far enough. The call that we should be sounding today is that *science is a method limited by language*. For creative excellence in scientific discovery and education can be elevated by emphasising the habit of mind that attends to precision with language — our linguistic readiness.

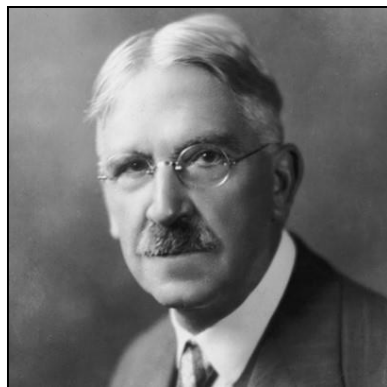


Figure 8. John Dewey (1859 - 1952). Dewey advocated for science as a method to advantageously modify the objects of your experience. Image Source: John Dewey portrait, Library of Congress, Washington, DC.

Recently, my colleagues and I published a scientific paper on nutrition and cancer prevention, and in the concluding paragraph we stated:

As scientists and health professionals continue to collectively re-think the role of selenium and other nutrients in cancer prevention, investigators must work to carefully document the form-dependent effects of nutrients. By avoiding a mindset of *naïve substitution* — seeing

one form of nutrient as equivalent to another — we make surer progress toward understanding the implications of our laboratory findings and side-stepping errant assumptions. (Chiang et al 2015)

As discoverers, each of us needs to avoid the trap that we have termed ‘naïve substitution’, the pesky product of insufficient exactitude with language. One might be inclined to ask just how well are scientists staying out of this trap. A consideration here of three examples taken from medical science research may prove useful.

First, let us consider the relationship between estrogen and cognitive function. There is a large body of scientific evidence indicating that estrogens promote cognitive function (Tang et al 1996; Luine 2014). But when the Women's Health Initiative conducted a large, randomised clinical trial in women, estrogens did not delay the onset of dementia (Shumaker et al 2003). Was this disappointing outcome an unexpected result? Perhaps not, if one considers that the trial did not test estrogen by itself, but instead tested an estrogen-progestogen combination of hormones. That is *naïve substitution*.

Consider the relationship between cognitive function and vitamin E. A 2002 study published in the *Journal of the American Medical Association* showed that vitamin E from food was associated with protection against dementia in older adults, but total vitamin E from food and supplements did not seem to be protective (Morris et al 2002). Why? I posited that these puzzling-on-the-surface results might be explained by the fact that the major form of vitamin E in food is gamma-tocopherol, whereas the major form of vitamin E found in supplements is alpha-tocopherol. *Could these two forms of vitamin E be non-equivalent when it comes to neuroprotection?* Yes. In fact, research published 13 years later showed that the circulating blood levels of these two forms of vitamin E have drastically different associations with the severity of Alzheimer's disease pathology in the brain (Morris et al 2015). Another case of *naïve substitution*.

Finally, let us consider the relationship between body fat and adverse health consequences. A 2004 study published in the *New England Journal of Medicine* explored whether women who underwent liposuction — the removal of 20 to 30 pounds of subcutaneous belly fat — would show improvement in risk factors for cardiovascular disease, indicated by changes in blood pressure, inflammation, and lipid profile (Klein et al 2004). Liposuction didn't work. None of the risk factors improved. Why? Perhaps it was because visceral fat — the fat that surrounds your abdominal organs — is the most metabolically active fat, far more sinister than the subcutaneous fat that resides under your skin. In fact, earlier rodent studies had shown that the surgical removal of visceral fat can significantly improve health parameters, in contrast to the removal of an equivalent amount of subcutaneous fat, which had no effect on these parameters (Gabriely et al 2002). In other words, *all fat is not created equal*.

On the surface these three reports of disappointing research results might appear to have nothing to do with language. Are not these stories just the consequence of loose thinking, improper attention to detail in study design? Here's the point: *Loose thinking is loose use of language*. This is because our use of words is foundational to the quality of our thinking, not just our ability to communicate those thoughts. The implications of the problem exposed here are non-trivial. What is every research question but a collection of words? And regrettably the examples given here indicate that language laxity-associated loose thinking can be spotted

within the world’s top medical science journals, the contents of which we rely upon to set the direction for future scientific and medical progress.

In this paper, I am making the case that an attitude of precision with language can catalyse our creative process and guide our interpretation of new information. *Naïve substitution is the product of language laxity* — leading to unsophisticated, even misleading categories. Figure 9 illustrates the desired evolution of a more nuanced category usage. The aforementioned liposuction study was not a study of the effect of *body fat*. It was a study of the effect of *subcutaneous fat*. Undoubtedly, precise language shapes precise thinking, making it more likely that scientists can sharpen their scientific method, avoiding the perils of *naïve substitution*.

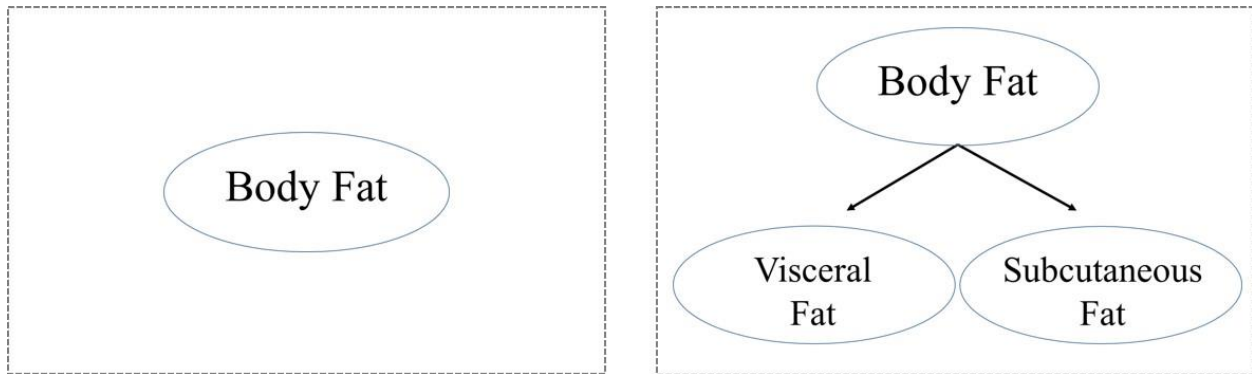


Figure 9. Our categories are our starting points: Two ways of thinking about body fat.



Figure 10. I. A. Richards (1893 - 1979). Richards coined the term ‘resourcefulness’ to refer to the rich ambiguity of words.

Image Source:<http://www.nndb.com/>

6. Achieving language precision: Will it be easy?

Up to this point, I have focused on outlining some of the potential benefits that an attitude of precision with language could bring to conditioning creative work. But will gaining the necessary precision be an easy task?

In his landmark work dating back to the 1930s, IA Richards (Figure 10) focused on the ambiguity of language. Beyond any other, Richards focused on the nature and consequences of this ambiguity, which he termed the *resourcefulness* of words (Richards 1942). Richards’ work informed that the ambiguity of words might present us with a formidable obstacle to straightforward sense-making [19]. That there is ambiguity of words is undeniable. Take for example the word ‘peruse’. The consensus usage of this word by colleagues I have queried is ‘to look over something in a cursory fashion’. Yet, the standard dictionary definition of ‘peruse’ is quite different: ‘examine carefully or at length’. And one’s shoulders will slump even further when one learns that the Merriam-Webster dictionary has recently added another definition for ‘peruse’: ‘to look at or read something in an informal or relaxed way’.

We may choose now to lament that the word ‘peruse’ may no longer hold utility. But what about the most important words? Richards explored this question, generating his own list of the 103 most important words in the English language (Richards 1942: 22-23) (Figure 11). And as his battle to understand words raged on, Richards hurled this sobering bombshell: *The most important words will always be the most ambiguous ones* (Richards 1942). It means we can expect trouble. It is no one's fault that these words behave so. It is a sign of their importance. That is the way language works — the other words roundabout in neighboring sentences are ready to shift their meanings to conform with the meaning assigned to the most important word that resides in that segment of discourse.

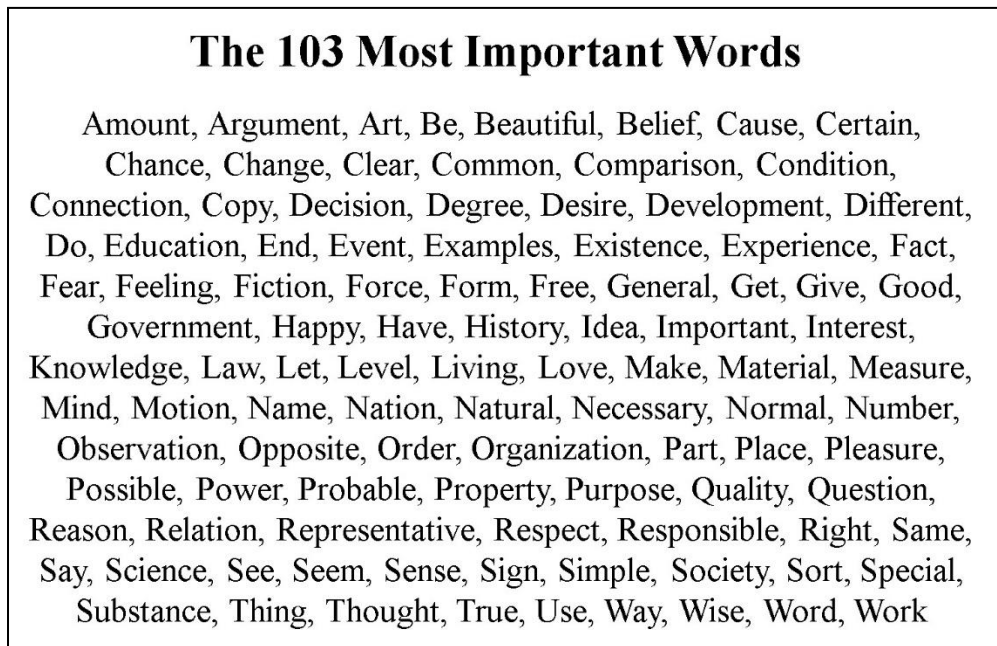


Figure 11. *The 103 most important words of the English language (Richards 1942: 22-23).*

What this means for us as discoverers is that as long as we are using the most important words in our domain, the ambiguity won't go away [20]. Even when words are used as flat descriptors, we must not ‘ignore their delicacy’ (Empson 1966: 236). These swirling possibilities of meaning stretch our minds, so that the meanings which matter most to us in the moment — singled out by our biases, our motivations — will emerge to form a part of our World (Richards 1942). It is altogether reasonable then that scientists and non-scientists engaged in creative discovery should envision their attitude of precision with language as a commitment to squeezing out of their method as much ambiguity in language as possible, but not as a recipe for eliminating it.

7. Synthesis

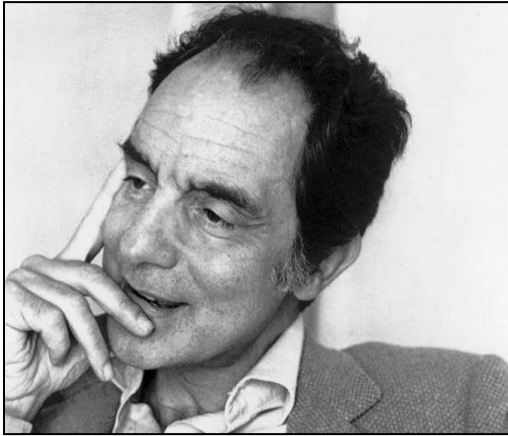


Figure 12. Italo Calvino (1923 - 1985). Calvino underscored the importance of an attitude of exactitude in literature. ('Italo Calvino' is licensed under PD-1996)

Just before his untimely death in 1986, the novelist Italo Calvino (Figure 12) sketched out a series of lectures singling out the handful of values or qualities distinctive of literature that future generations should hold onto as they attempt to advance the imaginative possibilities made possible through the written word. 'Language remains alive only if we set ourselves immeasurable goals, far beyond all hope of achievement', wrote Calvino in *Six Memos for the Next Millenium*. 'Only if poets and writers set themselves tasks that no one else dares imagine will literature continue to have a function' (Calvino 1988: 112). Among his five indispensable literary values, Calvino chose *exactitude*. To Calvino, an attitude of exactitude meant a well-defined plan of work and an evocation of incisive, memorable images. Moreover, exactitude meant using 'a language as precise as possible both in choice of words and

in expression of the subtleties of thought and imagination' (Calvino 1988: 56). Calvino's urge for exactitude emerged from his belief that we must oppose the loss of form in life using the weapon of literature. In this paper, I have sought to expose an underutilised opportunity to condition creative excellence in scientific discovery and education — through cultivating an attitude of precision with language.

After thoughtful examination, the importance of language precision to creative practice seems barely debatable. The way we choose to use language is the way we choose to live. That is because we see the world through our categories. Of critical importance to creative work, our words are our starting points — for present practice, for future inquiry. We find ourselves in pursuit of situational excellence and creative achievement amid permanence and flux. And today, an exponentially increasing access to information translates into an unprecedented flux of possibilities to navigate. How then are scientists readying themselves to productively reflect upon the challenge articulated by Wittgenstein 'to run against the boundaries of language' (Redpath 1972: 118)? *I contend that most scientists are unaware of the extent to which language limits their methods of discovery.* This is because language precision is largely overlooked or ignored as part of their training. Instead, scientists are trained to hold tightly to their belief in an all-powerful scientific method — intoxicated by the lure of specialisation, placing little premium on developing alternative angles of vision. Scientists intent on enlarging their creative performances would be well-advised to start stealing some pages from the humanities playbook, seizing the importance of language precision.

Now, I am envisioning the primary goal of education as *developing a richer vocabulary of Self description — the description of moving Self in changing World*. If you sell shoes, you need a lot of shoe words. If you are an astronomer, you need a bunch of star words. And regardless of your domain, if you intend to do creative work, you need words to be able to express your comfort with uncertainty, your embrace of a process philosophy that fosters intrinsic motivation, and your belief in failure as your richest learning opportunity — the unexpected cascade of attitudes that language precision can provoke. It is through developing

exactitude with language that we can emerge as the most eloquent descriptors of Self-in-World. We can become *neologistic discoverers* — growing beyond the confines of the analytical problem solver to becoming *imagero-analytical powerhouses of description*.

With this awareness and openness to the foundational importance that language precision holds for conditioning creative work, we move closer to a process of understanding Nature that echoes the method described by Henri Bergson:

We shall no longer say, ‘Nature is one, and we are going to seek among the ideas we already possess the one into which we can put it.’ We shall say, ‘Nature is what it is, and as our intelligence, which is a part of it, is less vast than Nature, it is doubtful whether any one of our present ideas is large enough to embrace it. Let us then work to expand our thoughts: let us strain our understanding; break, if need be, all our frameworks; but let us not claim to shrink reality to the measure of our ideas, when it is for our ideas, as they grow larger, to mold themselves upon reality’. (Bergson 1975: 208)

Equipped with this foresight, we can look to language precision as a tool that will enable us to enlarge our ideas, throw out worn-out frameworks, and assert our creative urge.

Though it is vitally important that we get this revision right, it is not going to be easy. Just listen to TS Eliot in his poem *East Coker*. Eliot contends that, regardless of our educational training, we are inarticulate and on a collision course with failure:

Trying to learn to use words, and every attempt
Is a wholly new start, and a different kind of failure
Because one has only learnt to get the better of words
For the thing one no longer has to say, or the way in which
One is no longer disposed to say it. And so each venture
Is a new beginning, a raid on the inarticulate

(Eliot 1970: 188-89)

But we must not be intimidated by the risk of failure. Creatives in any field of endeavor are artists always falling short of representing the Non-representable (Ottman 2004: 26). So let it become our goal to train scientific discoverers armed with the recognition that they too will always fall short of a complete description of Nature, so that they will see their method, their creative process, as being endowed with ‘the pressing-back of the Non-representable’ (Ottman: 157), rather than being possessed by a pursuit of what is contrived. Let us elevate the bar for those attempting to reach new heights of seeing, making, and reporting. For if we are successful in these re-orientations, we will have prepared ourselves to exploit failure as an engine that drives creative excellence.

A final thought

Herein, I have posited that to promote creative excellence in scientific discovery we need a new educational prescription — cultivating an attitude of precision with language. This shift in thinking brings into closer balance the tension between developing attitudes and developing knowledge content as we prepare tomorrow’s practitioners of science to make sense of the World — *to make sense of a world of words* [21]. It is tantalising to imagine just how central is the role

that language plays in orchestrating the processes that guide our perception and attention, that direct the conceptual linkages and chains of thinking that generate our creative responses (Feinstein 2006: 292) [22]. But like other attempts to crack the code of creativity, the exploring presented here quite predictably falls short of any satisfying final solution — providing perhaps a few fresh starting points, offering up some solid possibilities, but lacking hard conclusions. How then might one best conclude this envisioning of an uncommon prescription, put forward as part of an uncommon collection of scholarly works assembled in this special issue of *TEXT*?

More than 150 years ago the Sage of Concord, Ralph Waldo Emerson, wrote about heroism:

The characteristic of heroism is persistency. All men have wandering impulses, fits, and starts of generosity. But when you have chosen your part, abide by it, and do not weakly try to reconcile yourself with the world. *The heroic cannot be the common, nor the common heroic* ... Adhere to your own act, and congratulate yourself if you have done something strange and extravagant, and broken the monotony of a decorous age. (1968: 193; emphasis added)

Emerson was saying: *Do something heroic*. Collectively, these scholarly papers exploring the meaning of creativity and creative practice are saying: *Do something heroic in your domain*. To condition creative excellence in scientific discovery and education, I am saying: *Do something heroic with language*.

Endnotes

1. In his essay, *On the contribution of poetry to the search for truth*, Hans-Georg Gadamer develops the idea of readiness to be moved, even transformed by words (Gadamer 1989). Gadamer asks a penetrating question: ‘What is really presupposed when we let something be said to us?’ (106) The idea of listening with the intent of real change — what I have termed ‘brute openmindedness’ — is developed in Waters (2012).
2. I believe the general public sees language as primarily a communication device, whether that conveyance be through the spoken or written word. The primacy of language as a means of *representation* — of concrete objects, feelings, and conceptual schema essential to the process of thinking — rather than simply a system of communication is developed by Susanne Langer in her book *Philosophy in a new key*. See Langer (1960) for details.
3. The fragments we abstract from each encounter are filtered through Self, through culture, an observation that moved Italo Calvino in *Invisible cities* to ask the simple, yet profound question: ‘Is what you see always behind you?’ (Calvino 1994: 28)
4. Together with conceptual acumen and the art of framing, *perceptual acumen* is one of three components of a method of *dialogic self-awareness* — a critical approach that I have conceptualised for making sense of the world and optimising personal performance. Interestingly the three pillars of creativeness advanced by Calvin Taylor — reception, central processing, and expression in communication activities — parallel the language-driven triad that constitute my method of dialogic self-awareness (Taylor 1966: 371). In my scheme, exactitude with language, the focus of this manuscript, is one of the four meta-attitudes that are foundational to achieving dialogic self-awareness. See Waters (2012) for a further discussion of this method to achieve creative excellence.
5. Readers are referred to a recent book by Fareed Zakaria titled *In search of a liberal education*. Zakaria’s book passionately describes a growing, disturbing disregard for education in humanities

as a method for preparing people to live productive lives, thereby impoverishing our culture of achievement. See Zakaria (2015).

6. In this paper, images and thoughts of Galileo and other intellectual heroes of mine — Bergson and Calvino, Dewey and Poincaré, Richards and Stevens — are presented. The notion that tethering yourself to your own hand-picked assemblage of intellectual heroes can play a critical role in your quest for creative achievement and renewal has been developed elsewhere. See *On the self-renewal of teachers* (Waters and Waters 2011) and *The paradox of tethering: Key to unleashing creative excellence in the research-education space* (Waters 2012).

7. Like David Agus, my research group is committed to the use of the word ‘cancering’ — a constant reminder that if we are to more effectively engage in a battle against cancer, we ought to be lobbing our grenades at a process, not a thing.

8. In his poem ‘The idea of order at Key West’, Stevens wrote: ‘Oh, blessed rage for order, pale Ramon’ (Stevens 1964: 130).

9. In appendix B of his book *Punished by rewards*, Alfie Kohn points out the importance of considering alternate meanings for the term ‘intrinsic motivation’. Kohn writes ‘What appears at first blush an uncomplicated idea reveals itself as a tangle of possibilities’ (Kohn 1993: 276).

10. Psychoanalyst Rollo May considered the intensity of the encounter to be a critical element of the creative act (see May 1975: 38-44).

11. In my writings, I have emphasised the importance of cultivating linguistic readiness as a necessary complement to developing the technological readiness to which today’s educational agenda invests considerable attention. In a paper that appears in this issue of *TEXT*, Kevin Brophy emphasises a third readiness, one that respects creativity’s relation to time (see Brophy 2017). It is interesting to consider to what extent the cascade of attitudes represented in *The Failure Hinge* as products of language precision, namely process philosophy and intrinsic motivation, reinforce one’s readiness to accept the excessive, open-ended time commitments that characterise creative work.

12. Precommitment refers to the strategy of limiting your options to increase your likelihood of success — a strategy of ‘closing doors’ thereby funneling your future Self in a particular direction. Acts of precommitment intend to prevent paralysis and at the same time lessen the chance of travelling down less promising paths. Any strategy of precommitment serves as a constraining device. The term was first introduced into the peer-reviewed literature by economist Thomas Schelling in 1978. See Schelling’s paper ‘Egonomics, or the art of self-management’ (Schelling 1978).

13. A paper by Paisley Livingston focuses on Poincaré’s delicate sieve, creativity, and constraint in the arts, particularly as it pertains to the work of Jon Elster and Virginia Woolf (Livingston 2009).

14. The relationship between creativity and constraint has been discussed productively by Patricia Stokes (2006) in her book *Creativity from constraints: The psychology of breakthrough*. Stokes sees the creativity problem as both structural and strategic, advocating a selecting of constraints that steers away from usual solutions and promotes novelty. These aims are most readily realised by first mastering the existing constraints that define one’s domain, then devising the novel constraints that will expand it (Stokes 2006: xiv).

15. In his book *Teaching as a conserving activity*, Neil Postman commented on the transformative impact of cultivating language behaviors: ‘To speak new words in new ways is not a cosmetic activity. It is a way of becoming a new person. It involves learning new things and seeing the world in new ways’ (Postman 1979: 151).

16. 'Get the words out of your eyes' is a phrase used by Wendell Johnson in his book *People in quandaries* (Johnson 1946: 204). The TEDx talk is available at <https://youtu.be/XS9fiDn4Qo8>

17. Rather than saying 'We know that ...', my research group uses the phrases 'We believe that ...' or 'We understand that ...'. I challenge my colleagues, who are educators in academic settings or practicing health professionals who must educate patients, to try to refrain from saying 'know' for just one week. At first, it is difficult for them to break the habit of verbalising one 'know' after another. But gradually, with their new awareness, they come to temper their urge and see more clearly that the collection of stuff they 'know' is actually their beliefs.

18. This idea that every scientific manuscript could be titled 'A View Formed Under Special Circumstances' is developed further in the section 'On What is a Scientific Manuscript' in my paper *The paradox of tethering: Key to unleashing creative excellence in the research-education space* published in *Informing science* (Waters 2012).

19. But there is certainly an upside to the ambiguity of words. The ambiguity of language means each word is a universe of ideas that enables us to grow and change our concepts. This idea of versatility in language is further developed in Postman (1979).

20. Ambiguity, defined by IA Richards' student William Empson, is 'any verbal nuance, however slight, which gives room for alternative reactions to the same piece of language' (Empson 1966: 1). The fact that alternative views can be taken from any written text (even in the absence of overt misreading) should prompt careful scrutiny of every author's acts of ambiguity, which can be operational at the level of single words or combinations of words (i.e., phrases or statements).

21. In his poem 'Description Without Place', Wallace Stevens wrote: 'It is a world of words to the end of it, / In which nothing solid is its solid self' (Stevens 1964: 345). So too did the general semanticist Wendell Johnson write about the challenge of making sense of a world of words: 'the worlds we manage to get inside our heads are mostly worlds of words, words that become our unrelenting own. And so it is that in these worlds of words inside our heads we hold ourselves captive ... we take our words to be reality, and by so much we lose contact with the world outside' (Johnson 1956: 71).

22. The reader is referred to Jonathan Feinstein's *The nature of creative development* (2006) for a valuable conceptualising of the basis for creativity, in particular the connection between creative interests and creative responses.

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