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Curriculum Circus: Juggling Curriculum, Science, and The Arts

Domenica Devine

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Curriculum Circus

Juggling Curriculum, Science, and The Arts

by

Domenica Devine

(Under the Direction of Marla Morris)

Abstract

Education should open the door to better lives and better jobs. The fact is that it does not. In part, there are many causes including rigidity, political interference, and the separation between disciplines that we teach without context and without dialogue with our students. Specifically, I think that we should use education as a way to help students make better choices and have a better life. One way we can do it is by reconciling science with the other disciplines. And that is what is at the heart of curriculum studies.

There is a pervasive belief that the Western ideology of knowledge is neutral, and therefore must be good for all peoples in all cases. As a result education here in the West has not changed to address the needs of citizens in the 21st century. We have become a global community, and outsourcing our ideas has met with disastrous consequences. I believe that we have a societal obligation to help our fellow citizens navigate within an increasingly complex world.

Curriculum Circus uses the many metaphors of the circus to defend a polymerization of arts and science, a return to their common history. I start with the reconceptualization of William Pinar arguing for a “marriage of two cultures: the scientific and the artistic and humanistic” (W. F. Pinar, 1975/ 2000, p. xv). I then address

some of the open wounds of our education system: the lack of purpose, the lack of agreement among educators, the grip of politics, business and government in places where they should not intervene.

The circus metaphors present a space for communication and the polymerization of ideas. Circus is a collaborative art in which people can write, produce, and perform stories that are of concern in the public arena. As performers do culture, their curriculum includes the sciences and the arts: acrobatic biology, juggling physics, and wire walking through education. Circus gives us a place where we can play with ideas, and become clowns or acrobats or wire-walkers.

Here, I consider culture, community, and circus as integral elements in life's curriculum.

INDEX WORDS: Curriculum, Education, Science, Circus, Theatre, Art, Play, Performance, Teaching, Collaboration, Storytelling, Polymerism, Carnival, Communication, Currere

Curriculum Circus

Juggling Curriculum, Science, and The Arts

by

Domenica Devine

B.Sc. Biochemistry and Chemistry, California State University, Long Beach, 1996

M. Sc. Microbiology and Molecular Genetics, University of California, Los Angeles,

2003

A Dissertation Submitted to the Graduate Faculty of Georgia Southern University in

Partial Fulfillment of the Requirement for the Degree

DOCTOR OF EDUCATION

STATESBORO, GEORGIA

2012

□ 2012

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CURRICULUM CIRCUS:
A LOOK AT CIRCUS, SCIENCE EDUCATION AND CURRICULUM

by

DOMENICA DEVINE

Major Professor: Marla Morris
Committee: John Weaver
Daniel Chapman
Mary Aswell Doll

DEDICATION

For Michael

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Acknowledging my intellectual debts is my pleasure. Thanking all those who made it possible is important; without the support of teachers, friends, colleagues, and family, there would be scant words on these pages. My gratitude to all is immeasurable.

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FOREWORD

CHARIVARI: CIRCUS, SCIENCE, AND CURRICULUM



Figure 1: The Entrance. Copyright Terry Lorant. Reproduced with Permission.

Circus

In circus parlance, [charivari is] the traditional opening act, with clowns clowning, tumblers tumbling, jugglers juggling, general madness and confusion.

(Lorant & Carroll, 1986, p. 8)

It was the splendidest sight that ever was ...all through the circus they done the most astonishing things.

Huckleberry Finn (Twain, 1899, p. 198)

Foreword

There was madness and confusion, and it was the most *splendidest* life. When I ran away to join the circus, I was running in search of myself. I had the good fortune to join an extraordinary and idealistic group of players. Committed to a democratic experience, we worked toward community building, social justice, and ... having a good deal of fun in the process. Our small ensemble, *The Pickle Family Circus*, traveled throughout small towns of the US, working to dazzle, excite, astonish, and transform a bit of the world for our audience, stretching time with laughter. Madeline Grumet (1988) states in *Bitter Milk* “Curriculum expresses the desire to establish a world for children that is richer, larger, more colorful and more accessible than the one we have known” (p. xii). While we circus players may not have understood the terminology of curriculum at the time, we were definitely engaged in the practice. We used the stage to transform the mysteries of the earth. We used our knowledge to delight and surprise, changing an ordinary day to one filled with magic. We discussed inertia by sending juggling balls in the air in a fragile dance between earth and sky for a momentary escape. We substantiated the delicate balance between hard ground and soft sky by walking on the slim silver line of a tight wire. We talked about weightlessness, escaping gravity, by flying on a trapeze. We whispered only those tricks that were necessary, for “authentic mystery must remain mysterious” (Derrida, 1995). We laughed them into wondering at physics by disguising it as theatre.

We learned too. We learned the interesting concurrence of abject fear and sheer delight with the appearance of a clown. We began to understand what it meant to be a community; we came to feel a “transcendence that came from being together in a

particular way” (Greene, 1995, p. 40). We felt a participatory responsibility for the world we shared with our audience. Art mattered in our exchange.

I was fortunate to have found myself at a moment of transformation in circus history. San Francisco’s Pickle Family Circus along with the New York based Big Apple Circus independently envisioned the return to circus roots, and away from the excesses of Barnum and Bailey’s three ringed extravaganzas. Choosing the smaller one-ring style of traditional European style circuses, both sets of founders wanted to present an art form that would “be founded on a set of traditions that foster intimacy, artistry, attention to skill, and a feeling of ensemble” (Albrecht, 1995, p. 7). However, it was not just traditional circus skills that were being fore fronted. Pickle Family Circus founders Larry Pisoni and Peggy Snider changed the form by embracing the idea of commitment to a larger social purpose. As a result of their vision we were not the itinerant amusement that removed money from the community; instead, we traveled the country working with non-profits acting as a fund-raising tool. We were an event around which the whole community could gather (selling tickets, setting up their own midway with face painting, homemade goods to sell or games to play, or they could participate by taking Pickle clown classes or juggling lessons¹; our goal was to contribute something of ourselves to each community we visited.

Traditional gendered roles were cast aside as well. Women worked alongside men in the driving of trucks, driving of stakes, rigging of equipment, and erecting the circus

¹ The communities themselves determined what the midway would sell and where the profits would end up (day care, senior centers, community centers, etc.)

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sidewall. While the world of clowning was once the domain of males (who sometimes dressed as women), in this new circus, the job was now open to both sexes. We all had to perform countless tasks; my primary role was the stage manager, I was “back of house” and with the help of Betty Lucas, the “front of house”, we made the advance arrangements for the set up, determining the layout for all the rigging, sidewall and bleacher arrangements, insuring the audience would only be dazzled by skills, not blinded by sunlight. But, as a small group we had to multitask. Everyone did everything. I made costumes, drove a truck, loaded and unloaded equipment, pounded stakes, set up bleachers, helped with the sidewall, and sometimes juggled a little (we all did). Performers became roadies and roustabouts, and roustabouts transformed into performers.

It was the ultimate “open classroom.” Our stage was surrounded by the primary colors meant to entice and excite children of all ages. A garish set designed to take you away from your ordinary existence and move you into a space where everything was possible. Where ordinary people do extraordinary things. At the end of every performance, we joined on stage in the Big Juggle, performers and roustabouts all included, in our parting act of cooperation and community. With sidewall only and missing a “big top” we were open to ideas and to the atmosphere like an oculus. Looking

at the sky, everyone could dream of flight and fancy. I dreamed that I could be a fairy princess too².

Science

Things are not always what they seem; the first appearance deceives many.

Phaedrus

Perhaps it was the transformative nature of living and working in a circus but almost achieving alchemy, I became a scientist. Not exactly a fairy princess, but really really close. Of course, in both cases one gets to meet a lot of frogs, though with vastly different results.

Always a seeker, I returned to school. Abandoning canvas sidewalls and the nomadic life of sleeping in tents, I reveled in the order of bricks and mortar and indoor toilets, with a serene anticipation. Pencils sharpened and ordered, notebooks neatly lined, 50 pounds of books with crisp pages and shiny covers, revealing, with a satisfying crack, the smell of the mysterious symbols inside. It was like having a backstage pass. Backstage is where the magic takes shape, where mysteries are packaged for a spectacular “reveal.” You have to know the tricks and routines: how many clowns fit into a steamer trunk, or how much time it takes to rig the mini-trampoline between acts, or

² Pickle performer Wendy Parkman recounts, “ I remember the year we did the *élégante* act, and I sort of wafted into the ring as this white-faced fantasy dancer, and a little girl reached out and caught my hand and looked up at me and said, ‘I’m a fairy princess too!’” (Lorant & Carroll, 1986)

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how to divert attention quickly if something fails. I knew the circus; I knew theatre; now I was going backstage in the science workings of the world. It was exciting, and all I hoped for. As I began to dance through atoms and anatomy, entomology and electrons, transpiration and transmutation, each day revealed a new discovery, new magic, new music. A foxtrot with physics, a mambo with microbiology, a rather stiff Irish jig with statistics. No more was my ocular open to sun, stars, planet and sky; instead, my view returned earthbound, corporal at first, moving smaller and smaller, with the ocular now focused to magnify cellular structures. With high-powered electron microscopes only crudely able (at that time) to discern atoms down to 2\AA , the field was replaced with imaginings. Artists' renderings replaced the more tactile reality. Molecules danced in my head moving to Miles Davis' *Chasin' The Bird*.

Many songs, sonatas and symphonies later, degrees in hand, I had the good fortune to work in several professional laboratories that provided excellent experiences (UCLA for example), stimulating research, and inspiring conversations. I got my first taste of teaching in a classroom there. As a teaching assistant, I was responsible for passing on all I knew about Introductory Microbiology even though I had never had a Micro class before. I was transported back to days of improvising circus skills. It was a tightrope walk between acquisition and dissemination. It was leap of faith through a ring of fire. I came through only slightly singed and exhilarated.

When I finally began teaching introductory biology at an open enrollment university, I was ready. I was born a teacher. And now I was prepared. I loved learning, and I loved science. I knew I would be good at this. With molecular stardust in my eyes, I started to teach as "things as they were or are, things as they are said or thought to be, or

things as they ought to be” (Aristotle, trans. 1902). Meting out lessons as a “sonority of words, not [finding] their transforming power” (Freire, 1972, p. 57), I unknowingly embraced what Freire describes as the “banking” method of education. Looking lovingly at the “vessels” before me, I knew that they would want to know what I knew, to know things as they are thought to be. I knew I could fill them with wonder.

It was not long before the veil fell from my eyes. Bored and boring, students and I both became disenchanted with the lack of interaction, the strict reliance to a textbook, and endless sets of definitions. We all found ourselves pinned to points to remember for the exam. The science was autopsied with less care than would be used on a dead body. Knowing how “real” science is alive, but not having access to it, the disillusionment with the educational process hit hard (though my students seemed more accustomed to it than I). I reached out to my colleagues for ideas that might lead to a more satisfying exchange for everyone. Resistance was palpable, “This is how we’ve always done it, the smart students get it” or “They need to memorize vocabulary before we can even *talk* about concepts.” My colleagues seemed to believe that by questioning *our* teaching methods I was questioning *their* self-worth. That idea led to an inherent complacency as we worked to “just get students through” the class, as if it were a ...running of the gauntlet and not a more meaningful experience. I did not understand.

It was time to figure things out. Pinar (2004) suggests, “Understanding *transforms* how we discern a situation, and in that transformation, both we and the situation—organically connected—are changed” (p. 207). It was time for another transformation.

Foreword

Curriculum

The unexamined life is not worth living.

Socrates

And so I speak in multiple voices, telling stories of multiple worlds, often traveling within incommensurable vocabularies, a becoming-multilingual.

(Riley-Taylor, 2002, p. 69)

The field of curriculum studies is well positioned to act as a transformational agent of our current educational system. It is particularly well suited to challenge the hegemonic structures that continue to lead to destruction of our creativity, our compassion, and our communities. The field of curriculum studies reflects “a focus on understanding curriculum as encompassing and examining personal and political dimensions of the educational experience” (Miller, 2005, p. 20). This dissertation documents my passage into curriculum theory. First introduced to the field via the weighty atlas *Understanding Curriculum*, Pinar et al. (2004) provided a rich introduction to an assemblage of giants. The chapter headings appear as a map of the world, traveling through historical text, political text, racial text, gender text, aesthetic, autobiographical, theological, phenomenological, deconstructed text, and sailing beyond our borders for international text. Each text is reflective of the deeply “personal and political” understanding of education and curriculum by each of these practiced theorists. The *text* in this sense is symbolic of myriad ways of navigating a communication that extends beyond the borders of the printed page (though there are tens of thousands of these), into

other dialogic exchanges such as sign language, body language, hypertext, emoticons, twitters, and tweets. Moving through narrow shoals of entrenched ideology, prejudice and bigotry, the reconceptualized curriculum contains so many diverse voices, the result is that “curriculum is an extraordinarily complicated conversation” (p. 848). In the course of this dissertation, my own voice is added recognizing that there “are different voices singing variously on a single theme. This indeed is ‘multivoicedness’ exposing the diversity of life and the great complexity of the human experience” (Grossman in Bakhtin, 1984, p. 42). Philosopher Mikhail Bakhtin cites literary scholar Leonid Grossman to explain the importance of dialogue, which he insists is not mere words, but more importantly the basis of a relationship. It is “not the threshold to action, but the action itself” (p. 252). This is a multivoiced conversation, complicating the space in which it occurs. I present my own autobiographical understanding of those spaces in curriculum that position art and science as counterpoints of a dialogic relationship. While examining these ideas, I acknowledge that, “autobiographical writing enables students to study themselves. Such study links self to place, and place is simultaneously historical, cultural, and racial” (Edgerton, 1991, p. 78). So, while dealing with links between sciences and arts, this link to “historical, cultural and racial” permeates my place in the narrative, as do the rich experiences of living a life wide-awake, as Maxine Greene might say.

There are, of course, troubling aspects of exploring and embracing a discipline that rejoices in the idea of complicating conversations. But, education and educational research are hard work, and we can sometimes feel like Don Quixote tilting at windmills with a dulled or shattered lance. Will complicating conversations add to our difficulties

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with the giants who oppose any reform that appears on the quixotic horizon? Educator, philosopher, and political activist John Dewey (1938/1970) suggests, “it would not be a sign of health if such an important social interest as education were not also an arena of struggles, practical and theoretical” (p. 5). His was a lifelong devotion to educational reform, and a democratic and pragmatic approach to education. He was an outspoken advocate for educators’ rights, women’s suffrage³ and a tireless social critic. So, perhaps we can take some inspiration here. We too must do hard work, struggle to pick up our allegorical lances and perhaps learn some new ways to communicate—maybe offer a new circus act.

Polymerism in Curriculum

What would a curriculum be like if the curriculum began with the problem of living a life?

(Britzman, 1998, p. 49)

The word polymer comes from the Greek *poly* meaning “many”, and *meros* meaning “parts.” A curricular polymer is therefore a large molecule of knowledge made

³ John Dewey speaking at the 1911 Symposium of Women’s Suffrage said:

The strongest argument for democracy is identical with the urgency of the social forces that have compelled the partial steps already taken through out the Western world for democracy. It is my belief that woman’s political enfranchisement is necessary not only to complete the democratic movement, but that till so completed many present evils which superficial observers attribute to democracy instead of to the inadequate character of our democracy, will persist. (Dewey & Boydston, 2008, p. 153)

up of chains or rings of linked monodisciplinary units, like religion, schooling, politics, history, art, science and media. A life really. A life lived in the three rings of circus, science, and the complicated conversation of curriculum. The rings can also be drawn in a real circus, with each ring containing disciplined units of acrobatics, juggling, clowning, or the artistry of trapeze. In both cases as the individual components link together they form a stronger, more cohesive element—a world reimagined on a more corporal stage. When individual ideas are linked their meaning changes and becomes more complex. A rich, full, complicated life. Polymerism implies new co-functions, new synergies that emerge from the addition of work from different disciplines. It is the very definition of the curriculum field.

CHAPTER 1

CURRICULUM CIRCUS

I always hope that as a performer I'm able to come out with something that not only makes people feel inspired but even beyond that, I always hope that what happens on the stage makes people feel like they can do it.

Herbie Hancock

Using curriculum theory, this dissertation will explore the spaces between the cultures of arts and sciences, and in many cases link them together in narrative polymers reflecting the blurred boundaries. The arts and sciences will be treated broadly, as necessity dictates. The “visual arts do not exist independently of music, drama, poetry, literature, philosophy, and architecture” (Shlain, 2001, p. 25) nor do the sciences have sharp divisions between biology, physics, chemistry, and the accompanying technologies. As such, in the ensuing chapters, I will use the appropriate artistic or scientific model to best define the topic under investigation. Binding different models together will link ideas into the stronger polymers.

The main idea for this dissertation is the direct result of having spent my life performing in the rings of art and science. While I am not the first to suggest it (see the innovative work by Pinar 1975/ 2000, referenced throughout this text), I propose a return to the ideal of the polymath, the embodied synthesis of the scientific and the artistic. We can do this by constantly showing and experimenting with the links between various branches of knowledge, and by questioning the divisions. Both science and art influence nearly every aspect of everyday life. The sciences, including mathematics, are too often

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presented as independent modules without relation to their historical context, to art, or to our personal feelings. Indeed, the image of science as objective and rational implies that we have no personal relationship with science (even scientists know this is not true). With the velocity of change in science and technologies, which affect communication, health practices, food production, the water we drink, and the very air that we breathe, we should be educating our citizenry to understand science to meet the problems inherent in a fast changing world.

Perhaps we can move from the standard hierarchical and falsely presumed “objective” framing to a more honest, balanced, democratic dialogue? Let us return to our wild type nature that we might find a way to more effectively communicate science. We need to integrate the unexpected and unanticipated aspects of circus and story telling and humanness into the conversation.

Here the term circus is used both as a metonym for art as well as a metaphor for the lived experience. The circus becomes a tool for exploring and explaining the lived experience. To reframe Bakhtin...while the circus lasts there is no other life outside it.

Here, I suggest that the unusual, suspect, and theatrical presentation of the circus charivari in curriculum is precisely what is called for if we expect people to exchange and engage in critical and creative communication. The cacophony of charivari can act to move the needle of the seismograph, or create the vanishing point at which science and art can reunite.

Circus is a powerful mechanism that we can use for the interacting tasks of changing attitudes and communicate ideas. In some instances, circus, as a specific type of theatre, can “shape perceptions about human experience...that help to order our views

about humanity and the world in which we live” (Brockett & Ball, 2004, p. 12). Surely the flight of a glittering aerialist changes the way we see our earthbound bodies, lifting us to the sky, if only in dreams. We believe that we can fly, or leap, or dance on a wire. We believe, as Herbie Hancock hopes, that we can do it, and so we can.

Linking Rings

“The artist is a receptacle for the emotions that come from all over the place: from the sky, from the earth, from a scrap of paper, from a passing shape, from a spider's web.”

Pablo Picasso

In 1958 British scientist and novelist C. P. Snow delivered a lecture at Cambridge University describing what he saw as a dangerous gap between the intellectuals among scientists and the intellectuals of those in the humanities. He claimed it was not possible to “do both creative work in science and literature at the same time” suggesting the “psychological and physical strain would be too much” (Snow, 1960). Now over 50 years later, I think the situation has gotten both better and worse. Better in the sense that intellectuals and educators are reaching across disciplines to expand their understanding of alternative viewpoints, but worse, in that the chasm has broadened in the mind of the public.

My educator role has been primarily in science, the hard sciences of biochemistry and biology. Every semester students enter the classroom struggling with the misapprehension that they are required to choose one side of Snow’s gap. Fearful, they see the chasm as a walk without the aid of a tight rope or the comfort of a net. This,

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despite their full backpacks made of and filled with the products of artistic endeavors into sciences and technologies. This is not their first time encountering the spotlight that blinds their understanding. Each year their “knowledge” is reified into more tightly defined parameters, circumscribed by the questions in a quantifiable test.

Like the linking rings of an ancient Chinese magic show, the harmonic singing metal combination of living a life in theater, in science, and in science education insists that curriculum be used as a link. The narratives that follow are filled with artifacts and emotions picked up from all over the place. Juggling clubs are pulled from the sky and clowns wrestled from their silly dancing on the earth and evolution and ecology plucked from a web of science. These disparate monomers “complicate, even as I attempt to articulate” (Miller, 2005, p. 1). The solid rings link and unlink with equal flourish, forming glittering chains or perhaps some tarnished designs. Here is a chance for me to theorize curriculum that includes these rings as if presented by an up-close magician. Rings unspool into the wired threads of my story, to engage my imagination, to move through spaces that Janet Miller insists are filled with “story lines [that] twist and turn, collapse, and circle back on themselves” (p. 1). With autobiography as an inherent principle in curriculum, my story lines are twisted into patterns that are elemental foci in my life. The resultant chainmail manifests itself by consideration of topics of environment and politics converging in the spaces of humanities and science.

Using curriculum we find a place of dialogue that unites the two fields in areas of common ground. Regardless of the myriad ways of defining curriculum, it is without question a communicative process. Because curriculum is communicative it implies dialogue, and with true dialogue there is process. And because of that communicative

foundation, curriculum is flexible, mutable and always creating and recreating ideas and generating new meanings.

In the context of my present work, I entirely relate to this definition from Marla Morris (2001) in the introduction of *Curriculum and the Holocaust*, “Curriculum theory is the place/site that allows me to come home to myself, both emotionally and intellectually” (p. viii). I am at home here. Place and space are linked together. I trained in molecular genetics and microbiology; I drag my hand in the waters of physics and anthropology, I dream on the stages of theatre, and my heart is often on the road with the circus. Though not a scholar of feminist theory, I identify as feminist. I identify professionally as a writer and curriculum theorist, and following Donna Haraway’s (1997) lead I am applying for visas to other “permeable territories” (p. 49) and I may not always find myself at the destination I imagined, just as OncoMouse™ found itself on the other side of a wormhole.

Perhaps, if we move through the wormhole, we will arrive at the hall of mirrors where we can look into the mirror of heteroglossia. Bakhtin (1981a) claims this will “force us to guess at and grasp for a world behind their reflecting aspects that is broader, more multi-leveled, containing more and varied horizons that would be available to a single language or a single mirror” (p. 415). Let us look behind the apparent and grasp for something richer, more amazing, more complicated than the flat notes of a clown’s trombone. What if we were to live in the carnivalesque life where we could insert art into the ring with science and science into the circle of culture by creating polymorphic polymers: an experience where art, science, culture and technology are combined to

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formulate new ways to think, to create, and to understand. Maybe... we could create a new act?

Methodology

This dissertation is the platform for the telling stories of intersections between sciences, and art, and curriculum studies. Accordingly, throughout each chapter, I pay homage to the scholars whose work has led me to my own explorations. I “have been aided, inspired, multiplied” (Deleuze & Guattari, 1987/2007, p. 3). There is scant work in the field describing the polymers presented here, but that is not to say the contributions of numerous scholars did not inspire me to various “lines of flight [and through] movements of deterritorialization and destratification” (p. 3). The voices of curriculum theorists are prominent throughout, a brilliant cacophonous harmony of insights. “collective assemblage of enunciation” (p. 7).

My presentation differs from others in that I do not just talk about science and curriculum or the aesthetics of curriculum or arts education but instead find myself constantly moving forward and back through a semi-permeable membrane of ideas, combining disciplines, stretching definitions, imposing chaos, and suggesting order. In general I have pursued my own passions, making links that are highly contextual in the hope that readers find their own points of departure for their own lines of flight.

The vast range of intersections presents me with a mapping challenge. Accordingly, I use the form of *bricolage* as the method of research and discovery. The concept of the *bricoleur* is one who improvises with materials that are ready-to-hand.

“The French word *bricoleur* describes a handyman or handywoman who makes use of the tools available to complete a task” (Kincheloe & Berry, 2004, p. 16). Anthropologist Claude Lévi-Strauss (1966) introduced the concept of *bricolage* suggesting that “*bricolage* on the technical plane...can reach brilliant unforeseen results on the intellectual plane” (p. 17). Denzin and Lincoln (2001, 2005) adapted the concept to embrace the multiple methodologies used by qualitative researchers wherein the researcher or “*bricoleur* adds different tools, methods, and techniques of representation and interpretation” (p. 5). Building on that idea, educational researcher Joe Kincheloe refined the *bricolage* research metaphor with the help of Kathleen Berry (2004), Yvonna Lincoln (2001), William Pinar (W. Pinar, 2001), and Peter McLaren (2001). This adaptive method forms a flexible framework for managing complexities of doing curriculum research in the postmodern era.



Acknowledging the structure of the texts *How We Work* (Morris, Doll, & Pinar, 1999) and *Triple Takes on Curricular Worlds* (Mary Aswell Doll, Wear, & Whitaker, 2006) as well as many other fine volumes in the curriculum field, I follow the guidance of the essayed chapters. I recognize the way in which the postmodern reader examines and interacts with texts, often skipping around to find meaning, or starting somewhere in the middle. Just as in Chaucer’s rhizomatic *Canterbury Tales* or Cervantes’ *Don Quixote*, the chapters exist as stories with differently carved frames with “multiple entryways” and scaffolding of concretions of bulbs and tubers. Deleuze and Guattari (1987/2007) suggest that a “book ... forms a rhizome with the world” (p. 11) a rhizome which “ceaselessly establishes connections between semiotic chains, organizations of power, and

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circumstances relative to the arts, sciences, and social struggles” (p. 7). It is this rhizomatic movement aided by the many tools implied in bricolage that I attempt. In doing so, I hope that it lends freshness and multiple forms of entry into the text. In his analysis of the everyday practices of life, the playful philosopher and cultural theorist Michel de Certeau (1984) sees *reading* as a form of bricolage—a space for games and tricks—and one of the many strategies of creative resistance to power structures. I join him in suggesting that not only is bricolage a research technique for the writer, but it is also a way for readers to claim autonomy by constructing their own interactions with text.

Introduction to Chapters

Chapter 1: Center Ring

The first chapter is introductory, providing history and background. As foundation, I introduce some of the curriculum theorists and other thinkers that illuminated my path with Gobo lamps, twinkies, and spotlights. The foremost theorist, William Pinar, while not always center stage, is the ringleader of the show. Pinar (1975/2000) has worked tirelessly with brilliant erudition to advance the field of curriculum studies for over 30 years. His reconceptualization of the curriculum field called for the ambitious “marriage of two cultures: the scientific and the artistic and humanistic” (p. xv). His continued teaching and scholarship has spawned generations of theorists who bring insight and new vision that enliven the field. It is these women and men who form the ring of thought. No discussion of curriculum can begin without some foundational thoughts on Pinar’s (2004) notion of *currere*, the course taken, as well as the presumed

course ahead. This chapter will touch on some of those ideas. Further, this chapter applies those concepts to some of the problems of science education, finalizing with some thoughts on how curriculum studies can provide some insight into reconceiving the field.

Chapter 2: An Elephant of an Education

In this section, I use the old metaphor of the elephant in the room to introduce and summarize some of the open wounds of our education system: the lack of purpose, the lack of agreement between educators, the grip of politics, business and government in places where they should not intervene. An elephant always appears in the room when there are important issues that no one wants to talk about. The elephant's size can represent the enormity of educational issues that are so big and complex that in the examination, one might only be able to grasp a very small portion. Elephants appear too big to confront. I showcase the elephant in several settings using her as a foil to discuss these elements of contemporary education.

More in-depth questions are also examined in greater details: is it the role of the educator to tell children what is important? Why do we teach science as a block of permanent knowledge isolated from life? We treat science as an assumed permanency ignoring its inherent fluidity. Why do we assume knowledge has no social context? While weighted down with so many questions, the elephant still performs with elegance and grace. One way to confront the elephant might be to increase the communication between students and professors.

Chapter 3: Curriculum and the Circus

This Chapter will use the metaphor of circus as a space of communication and the polymerization of ideas. I introduce the notion of the circus arts as a distinct form of

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theatre and as a creative way to engage a more democratic and dialogic curriculum.

Circus can enliven the dialogue within curriculum studies. The charivari allows us to incorporate ideas that are important in both the realms of science and art, since it is all in the ring at once. It is a call for students' participation, to bang the cymbals, juggle ideas and leap through ideas. Science, of course, has always been about circus, with ideas and discoveries being presented with a "Ta-da" flourish. The "Eureka" moment is much heralded.

Circus is a collaborative art in which people can write, produce, and perform stories that are of concern in the public arena. Circus reflects the concerns of the every day, because its essence is that of "creating and living at the same time" (Fellini in Stoddart, 2002, p. 47). Aerialists are in love and fill their act with temptations; jugglers toss their fiery clubs into the air bringing their passions to the ring, imitating battles and doing politics; the acrobats vie for power and the quaternary consumer⁴ position, while the clowns act out comedies and tragedies both, all reflecting specific paradigms of our culture. As performers do culture, their curriculum includes the sciences of biology and physics, chemistry and history. So this chapter explores some of those places where a polymer is formed and a new crystal of thought is nucleated.

Chapter 4: Circus Acts

In this chapter, I explore the slippery notion of curriculum of space. I put different scholars into the center ring and examine ways in which these women and men have

⁴ In a given ecosystem's food web, the quaternary consumers are at the top of the pyramid and have few natural enemies in their native environments.

created, explored or bridged the spaces within and between the arts and sciences. I will look at how the spaces were filled with some novel understandings of the connectivity between them. Within this framework I am also looking at my journey to understanding the fundamental problems in science education. As I see it, there are two main themes that evolve in this endeavor. First, we continue to educate as if the student is a *tabula rasa*, a recipient without any preconceived notions about how the world works. Second, in spite of repeated attempts at dispelling this blank slate myth, there remain numerous obstacles in the path to change in education. It is with these foundational ideas that I begin to analyze the deep causes that prevent the use of other disciplines in the exploration of science. What do we want when we teach science? Primarily, we should teach science so that the students make better choices and have a better life.

Chapter 5: SeaWorld: A Whale of Curriculum

SeaWorld is billed as the circus of the sea. Using primarily ocean dwelling animals to perform the tricks, these animals get top billing, while their human animal trainers play second fiddle and comic foil to these aquatic acrobats. So with a narwhal as star performer in this chapter I embark on a performance nautical in nature.

There is a pervasive understanding that the Western ideology of knowledge is neutral, and therefore must be good for all peoples in all cases. As a result science education here in the West has not changed to address the needs of citizens in the 21st century. We have become a global community, and outsourcing our ideas has met with disastrous consequences. It is because of the pervasive and sometimes insidious nature of science and technology's effect on ethics, behavior, and culture we need to help the public to understand how science works. Third, in order to have a more just and

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democratic world, I believe that science literacy is paramount; it is necessary to the democratic dialogue. I also believe the way to achieve such a dialogue is to bring new and more textured stories to the commons. I believe that we have a societal obligation to help our fellow citizens navigate within an increasingly complex world. And science is an increasing influence on that world.

It is important to interconnect and polymerize the humanities and the sciences for a more complete understanding. I believe we need to consider culture and community as integral elements in the life science curriculum, and I believe we can do this through stories with an intersecting curriculum of the arts and sciences.

Act One: Enter the Giants

We are like dwarfs sitting on the shoulders of giants. We see more, and things that are more distant, than they did, not because our sight is superior or because we are taller than they, but because they raise us up, and by their great stature add to ours.

John of Salisbury (ca. 1115-76)

Curriculum is concerned, broadly, with education both in the schools and the commons⁵. The commons, as does curriculum, reflects the messy nature of a public square, which includes a diverse group of cultural identities, moral understandings, and multiple traditions of knowledge. What remains common outside these distinct traditions is—commonality. There is the difficult practice of democracy, the constant challenges of

⁵ For an excellent and passionate discussion on understanding the commons see (Bowers, 2001).

cross-cultural exchanges, the difficult balance of self-interest over the good of the group—all of which stem from the desire to live well and safely.

Just as the commonality of the commons and curriculum is celebrated, diversity is equally important. As such, the curriculum field has grown and matured; it has also fragmented into specializations. Gathering ideas from culture, politics, history, and social sciences, Pinar (2007) put curriculum and education into the center ring. He distinguished fifteen specialties, and with each fracturing there is a creation of a new polymer. For example, Morris' (2001) work on the Holocaust embodies Jewish curriculum studies and is strengthened by the psychoanalytic and narrative qualities she brings to the text. Reta Ugena Whitlock (2007) links together a polymer of autobiography and place-making with queer theory. Both of these works are strengthened by threaded historical underpinnings. The sheer breadth of field demands of scholars the development of thoughtful, reflexive, critical, and complicated ideas. The deconstruction and subsequent reconstruction of ideas in a new text, encourages critical thinking and an appreciation of open, pluralistic societies. Socrates (Plato, trans. 1991), in Book I of Plato's *Republic*, asserts, "It is not just any question, but about the way one should live" (p. 31). Though the utterance Socrates posed was in reference to justice, curriculum is also infused with ideas of justice. Curriculum is about the way one should live. Curriculum demands that we think big, deep, and reflective and critical thoughts about our selves, our society, and how we live and how we hope to live. Fortunately, we can stand on the shoulders of giants.

My work has been transformed by the work of giants. The curriculum texts I cite in this and subsequent chapters are the result of thousands of hours of the authors'

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scholarly endeavor. I am deeply indebted to those women and men who stimulated my imagination and my passions to explore curriculum alongside them. A stilt walker, I rely on a multitude of curriculum theorists, scientists, playwrights and other philosophers to help me keep my balance, and encourage me see things that are more distant. I employ a scholarly inquiry of curriculum that is transformed by a polymer containing different links to my autobiography, which includes monomers of circus, science, and curriculum. As curriculum theorist Grumet (1980/1999) tells us, autobiography is an inherent part of curriculum. It is this theoretical through line that I embrace. It is the method by which my own curriculum is reclaimed and reconceptualized. She suggests that in the process of “selection of some events and the exclusion of others”, that we might see our own “processes and biases at work.” (p. 25). These small snapshots of my life journey are by way of examining and understanding the roots of my interest in the curricular spaces of art and science. In this introduction, I have specified a ring holding three monomers: circus, science, and curriculum, and by the circumscription have excluded others. I define the ring by selecting the primary colors of circus canvas, though not my only exposure to theatre. I have selected some of the feelings I recall during my schooling in science, excluding much of the more tedious and quotidian practices. By making my selections, I draw a ring around the performance, selecting some events and excluding others, linking them together into a unique polymer. I choose the circus as a way to think about curriculum, because it is rich with metaphor and allegory. I choose the circus as a way to work through difficult ideas. I choose the circus and the circus chose me. I am the embodiment of this unique theatre, so I know the circus gives us a new way of seeing how we are in the world.

Philosopher Karl Marx well understood that new ways of seeing were necessary for the advancement of human beings. He saw the effect of economic and social forces on society, on our very humanity. A fierce advocate for human freedom, perhaps he recognized the transformative and healing nature of the circus in the flight of the acrobat.

When we see the back of an individual contorted in fear and bent in humiliation, we cannot but look around and doubt our very existence, fearing lest we lose ourselves. But on seeing a fearless acrobat in bright costume, we forget about ourselves, feeling that we have somehow risen above ourselves and reached the level of universal strength. Then we can breath easier. (Marx in Albrecht, 1995, p. 8)

Marx clearly loved the circus. Seeing the counterpoints of life, for all his work on economic and social conditions, he knew we needed to laugh, to breathe easier sometimes. Scientific studies show we do breathe easier after a good belly laugh. But we already knew that, from somewhere else, from somewhere deeper. The circus does enrich us and uplift our spirits; the circus inspires us to rise above ourselves; the circus inspires us to dream and to see things differently. The Pickle Family Circus was a cooperative, not the perfect classless society Marx may have envisioned. A product of the counterculture of that era, the dream was to steer the circus away from the carnary spectacles of old, restructure oppressive social orders, ignore market forces, and put the circus into a new relationship with the community. It was a new vision.

As I bring these ideas forward, I want to see if we can use some of this revolutionary heritage to combine different ways of seeing, different ways of accessing ideas about education. We are a complex species, prone to contradictions of cooperation

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and competitiveness. Holding paradoxical ideas is a highly adaptive trait in humans, so it seems quite unnecessary to exclude one form of thinking from another. “Why should there be only one way to think well, only one way to have fun with our minds? Why is mental monogamy required? Are we still fighting about monotheism?” (Traweek, 1996, p. 148) Traweek teaches in the history department at UCLA; her scholarly work focuses on the culture of science. She questions the nature of monolithic thinking. She questions the restrictive nature that grand singular generics—science, god, justice, man, woman—impose on our understanding of how we are in the world. This follows the nature of my inquiry. As a scientist for years, I admit, I fell in to the monotheistic view of how science was done, even as I managed multiple ways of doing it. The paradox was as easy to juggle as two balls, as only one is in hand, or in mind at any given moment. As Traweek reminds us, Thomas Kuhn’s (1996) exposure of the *Scientific Revolution* did scant to change the narrative about how science happens. Entrenched, I continued to parrot the party line, even to the detriment of those outside my field with whom I wished to communicate. Even as we sat over coffee exchanging the ideas with which we are captivated, it is still presented as an impersonal truth which does not respect the process, the history, or often even the intentions of scientists.

Perhaps Traweek (1996) would scold me then for the generic use of circus, but in using it as a different way of analysis, perhaps I will be forgiven; her idea was to invite us to dance, “to run any old idea through the gamut of twosies, threesies, and foursies, with a finale of Busby Berkeley-style ascending and descending of hierarchical steps” (p. 146). My idea is to invite us to the circus. We can be acrobats and clowns and frolic

through back bending mazes. We can decorate our bodies with tattoos signifying nothing but whimsy.

Why remove the play and whimsy from education and reinforce unconstructive and exclusionary stereotypes? Why pretend that ways of knowing are absolute, definable, and neutral? Even scientists will admit that this is not so, though usually not in public. Why not learn from the excesses of circus representations? The colors are bright; the music is loud; the animals all perform in unexpected and extraordinary ways. And there is always magic.

This dissertation presents an opportunity and an obligation to clarify a charivari of ideas, to bring together the jugglers and the acrobats, artists and artisans, scientists and scholars as they perform on the same stage. It requires that I view the world and my own actions in the world critically and with care, and to present them as clearly as I know how.

As such, I rely on my past experiences in the theatre and in circus arts. I also link to my knowledge as a working scientist and science educator. I am bound by my own experiences as a learner in these fields, as well as fields farther. But this dissertation is not about the theatre or circus arts, though there will be performance a plenty. This dissertation is not about science although one may learn a little philosophy of science in the engagement. This thesis is not about science education though tales from the classroom do make their appearance. It is my unique biography and my understanding of my own experiences in circus, science, and in education that I bring to bear on the curricular conversation. I am sometimes questioned on how I made the leap from circus

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to science, and the truth is I did not see the yawning divide that others see when holding these two career paths in mind. Add in curriculum, and the three fit neatly, if sometimes contradictorily, into one head, mine. Though contradictions exist, all require discipline, perseverance, study, practice and hard work. Each requires dogged determination in the face of obstacles, pitfalls, fallbacks, and dropped clubs or dropped ideas. All insist that I look at problems with a renewed and honest sense of curiosity as well as a determination to go over old ground. Each requires creativity, imagination, and an enduring sense of humor.

We are talking about curriculum. And while the notion of curriculum can be elusive, let us place it temporarily within the sidewall of the circus while it is in town, throwing the meanings into the air with all the skill I have as a juggler, and tossing them to you the reader, to decide if you want to play or not.

Curriculum theory is a powerful tool that can be used to navigate the space between the humanities and sciences. Historically, the link between art and science has been very close. One of the most famous of that ideal is, of course, the polymath and giant of science and art, Leonardo da Vinci. He is the integrated embodiment of artist/scientist, “the prototype of Western man in his utmost accomplishment, Renaissance man in his utmost splendor” (Payne, 1978, p. xv). But even as he is now mythic for his accomplishments, Signore da Vinci’s work is presented as fractured. As Leonard Shlain (2001) points out in *Art and Physics*, da Vinci “made many contributions to science, both in theory and application” (p. 74), but he is studied primarily by art history students and more rarely by scientists. By parsing him into smaller pieces, we

neglect to see how his whole body of knowledge informs and contributes to each of his endeavors as a painter, sculptor, architect, engineer and scientist. With no formal education in the sense that exists today, da Vinci learned organically. The world was his toolbox, with all knowledge available to tap into to address the problem at hand. An organic thinker, his method of dynamic sketching has figures emerging from the chaotic scribbles with seeming spontaneity. A systemic thinker, Leonardo compared the proportions of the human body to the proportions of buildings. He linked together the monomers of his life and saw connections in the patterns of water turbulence and the flow of air leading him “to explore the nature of sound, the theory of music, and the design of musical instruments” (Capra, 2007, p. 5). Leonardo was profoundly interested in the ingenuity of nature’s design; “his principal tool for the representation and analysis of nature’s forms was his extraordinary facility of drawing” (p. 5). His artist and scientific qualities could not be separated. He observed the world around him with the practiced eye of an artist and a scientist, with “useful applications of his discoveries” (p. 7) not far from his mind. A man with a curious and playful mind, his notebooks are filled with puns and jokes. A holistic thinker, Signore da Vinci pursued his curiosity and passions and used integrated concepts of science, art, and technology as tools to bring his art, science, and designs to fruition.



Science, as its own entity, grew organically from the arts. Kings and nobles were the original patrons of the arts, showing their wealth, status, and educational acumen by

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collecting art, artists⁶, and architects. Wealthy men would use their patronage to forward their political agendas and social positions, building grandiose architectures as testament to their prestige, sophisticated taste, and as an announcement of good breeding.

Work in both fields is still performed at the pleasure of the metaphorical “kings.” Politicians change the course of research with the decree of “war on cancer”⁷. With this verdict, other researchers lose their funding opportunities and even the opportunity to have their work valued by other scientists. In this political cycle the educational focus shifts to reading and math, so physical education, music, and the arts all get sidelined.

Our current educational system takes the tools of art and gives them only to those in an art class. The tools of biology are carefully kept out of the hands of those learning art. What if we gave everyone some juggling clubs? A point of interaction, connection and required cooperation. I believe that the separation of disciplines, while valuable in the advancement of each, has also led to the failure of communication between the disciplines and between people. And without communication there can be no understanding. As theorist Marla Morris declares, “Curriculum theory is a call to understanding” (2001). If we are to meet the demands of the 21st century, can we do it by restricting our vision or our imaginations? By closing off the oculus? By integrating the tools of arts and science, we can infuse learning with creativity and the conceptual

⁶ da Vinci had several patrons including: Duke Ludovico Sforza of Milan, the powerful Medici family of Florence and King Francis I of France.

⁷ While the legislation does not mention “war”, politicians have asserted that status in rhetoric since The National Cancer Act was passed in 1971.

thinking inherent in both disciplines. Then we will open avenues to understanding the complexities of the world around us.



In addition to the authors already cited in this dissertation, I will continue to acknowledge the contributions of those who have come before and continue to teach me new ways of thinking. It is important to recognize the work of scholars who have paved the way through the field. I honor that essential principle and while I “testify to the future by protecting the past” (p. 5), in order to situate myself in the field, I will use occasions of autobiographical narrative.

Supporting that idea, Elaine Riley-Taylor (2002) describes her writing as being interrupted by passages of autobiography. She claims this allows her to use her “musings and murmurings” to convey the passion she feels about her “kinship with the natural world” (p. 67). I too, will “intentionally interrupt the linear stream of the more formal “objective” language valued within academic tradition and move in and out of personal narrative through the body of the text” (p. 64). Typically in academic writing, A leads to B which leads to C leads to D. I intend to disrupt this narrow definition and take a different path. My intent is not to obfuscate, but to more closely align this text with some common practices and understanding of research writing. In the spaces of circus, science, and scholarship, what I notice is that much of the research, does not follow a straight course, and is often diverted by quantum⁸ leaps of insight or passion. More often the path

⁸ A quantum is an infinitesimal movement, but is often used colloquially to refer an enormous chasm. Here, paradoxically, it can be used in either context.

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doubles back on itself, winds in helical patterns, leads to blind alleys and cul-de-sacs. While sometimes it leads with surprising accuracy to a new understanding, sometimes it leads you with startling disappointment back to where you started. Mary Aswell Doll (In W. F. Pinar et al., 2004) in her research invites us to think of our lives as circular, with “points looping dynamically from within: your outer journey roundly connected to the spiral of your inner self, the center geyser of your being.” (p. 544) In re-search, (as in life), A very often leads straight to D and circles back around until you find B masked as the rock on which moments ago you were standing to gain some perspective. C turns out to be the part that you had inadvertently edited out of your thinking. You have to re-discover it by walking along the same passageway. A metaphorical change to those letters symbolic of the polymer DNA⁹, AGCT, and my vision is more helical, mirroring structural qualities of DNA, all tightly wound holding secrets in places that are teased out with time and patience, structured loops with information for renewal, codes for the imagination as well as the yet unimagined, and tentative holds between strands holding fast to history on one side, but open to changes. A polymer like no other, DNA writes our future and our past all at once, adapting to the context of its environment. “Curriculum”, like DNA, is “changing as we are changed by it” (W. F. Pinar et al., 2004, p. 848). I have been changed in ways that are not always readily apparent. Sometimes I am startled by insights that recall my time standing in front of a sequencing machine. Red, green, blue, and black inkjets would document the seemingly random sequence of AGCTs like

⁹ The letters AGCT are not symbolic in the same manner of ABCD, but each represents a very specific chemical monomer.

overlapping heartbeat traces written like an EKG of living molecules. Sometimes I am surprised to find myself juggling ideas with visions of proteins wrapping, folding, and taking the physical identity of each idea. Sometimes it is closer to a dream on the gaiety of water as Bachelard (1942/1983) whispers in my ear, “This is what is heard near the river—not its voice but a sigh” (67). The diversity of my experiences has given me a lot to work with. It has left me with a million stories to tell, and many different courses to run. Come on, let’s go.

Running the Course

There is an itch in runners.

Arnold Hano (1922 –)

I always loved running... it was something you could do by yourself, and under your own power. You could go in any direction, fast or slow as you wanted, fighting the wind if you felt like it, seeking out new sights just on the strength of your feet and the courage of your lungs.

Jesse Owens (1913 –1980)

In the last decades the field of Curriculum has exploded in different directions. This is very explicit in the work of Pinar et al. (2004) *Understanding Curriculum*, wherein Pinar states, “The American curriculum field has undergone a profound shift during the past twenty years, a fundamental reconceptualization of its primary concepts, its research methods, its status, and its function in the largest field of education” (p. 12).

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Most curriculum theorists not only acknowledge but also confront the non-neutrality of education systems. They recognize the array of stakeholders and their distinctly partial positions toward knowledge production. The interdisciplinary nature of curriculum theory addresses the nature of the public education system and education in the commons, and follows Pinar's (2004) call that "requires us to teach academic knowledge, but configured around faculty and student interests, addressed to pressing social (including community and global) concerns" (p. 21). Curriculum studies as a discipline seeks to address ideas beyond the academic coursework (like art history or biology) found in educational institutions. Instead, curriculum study seeks to problematize school lesson plans by recognizing what educator Philip W. Jackson (1990) refers to as the "hidden curriculum" (p. 33). While Jackson is referencing the implicit values embedded in the complex interrelationships of "the crowds, the praise, the power" others have expanded the meaning to include other social constructs including race, gender and class, and to use these constructs in the discussions of epistemology. Questions about what we know, how we know, and how knowledge is constructed are widely debated and invite each theorist and philosopher "to throw light on truth and falsehood" (Russell). This epistemological understanding of curriculum precludes the designing of rubrics or lesson plans and instead is an invitation to "become wide-awake to the world" as Maxine Greene (1995) challenges us to do. Becoming wide-awake could include seeing the world more organically, more holistically as did da Vinci. Becoming wide-awake can include a curriculum of communication that complicates the idea of hidden agendas of social politics inherent in schooling. Educator and curriculum theorist Jayne Fleener (2002) wants to "recreate heart" in schooling—to "reinvent the passion for

and love of learning that seems to be missing in our standards-driven curriculum” (p. 3). To put heart back into schooling, to complete a holistic understanding she insists that an integration of “teaching, learning, society, school, and the curriculum are different aspects of one basic meaning structure” (p. 3). She is looking at the holistic and viewing it from different aspects, trying as it were, to show us many facets all at once. Using her laser sharp skills as an educator, and perhaps a mathematician’s reflexive understanding of parallax she presents us with a unique perspective. Measuring ideas from different lines of sight, she claims that our “understanding of the complexity of the curriculum entails a holistic, multiperspectival, holographic approach to exploring our own experiences with schooling” (p. 3). The multiperspectival approach she advocates can come in many forms. For this dissertation, I invoke the different rings of the circus, science, and curriculum as a way of looking beyond them in a distinctive holograph of observations.

The notion of curriculum itself is complicated by its nature. First, in this context, we move from thinking of curriculum in its function as a noun; we instead propel it in to new context. It becomes a “verb, an action, a social practice, a private meaning, and a public hope...the product of our labor” (p. 4). So, we must once again, dispose of the misapprehension of the word which has been conflated to the paper flatness of a syllabus or lesson plan. I say once again, because in spite of best efforts of Pinar (2004), Grumet (1988), Doll (2000), Weaver (2001), Morris (2001), Greene (1995), Apple (1993), and Ayers (1998) and scores of other giants in curriculum theory, the practice of curriculum theorizing has, for many educators, become anathema. “Curriculum has become so formalized and distant from the everyday sense of conversation” (Gough, 2007, p. 280)

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that they think they carry their curriculum in their briefcases. But, curriculum is a vibrant, living, and evolving entity, unable to fit into even a superhero's briefcase, particularly after 30 plus years of intense scholarship, debate and publications.

To untangle the complicated nature of curriculum, Pinar (2004) removes the word from the awkward though thought provoking future passive voice to the active infinitive and its Latin root "currere...to denote the running (or lived experience) of the course" (p. xiii). This active voice imbues it with an energetic living insistence. There is an itch. There is a need to move forward, to run, to break from the pack and head out towards uncharted territory. Discussed initially in the 1976 edition of *Towards a Poor Curriculum*, Pinar and Grumet (1976/ 2006) laid a course towards "resistance to the mind numbing bureaucracy...that [was] dominating educational research" (p. vii). Currere was an action that pushed against the winds of the accountability trend that has become even more insidious in recent times. They had their sights set on the future, and while acknowledging the windmills of resistance, they began a process of reconceptualization of the field of curriculum, seeking to "understand human experience of education" (W. F. Pinar, 1975/ 2000, p. xiv). Pinar carved out an ambitious path toward a reconceptualization that he hoped would be a "synthesis...a marriage of two cultures: the scientific and the artistic and humanistic" (p. xv). And this is precisely where my challenge lies, theorizing a marriage between two cultures that have been divorced for centuries. What does it take to heal the wound between these two families? René Descartes is often credited with wielding Solomon's ax, creating a new philosophical paradigm. It was useful inasmuch as it allowed science to evolve without the constraints of religion. Nowadays however, it isolates science from human experience. Can we

create a present-day prototype by theorizing renewed marriage vows between the disparate disciplines? An ambitious challenge, but having removed curriculum from the briefcase of academia we can open up the dialogue beyond the school walls and move into the public sphere. Recalling a divided da Vinci, I look to bell hooks, who reminds us that “it takes courage to embrace a vision of wholeness of being” (hooks, 1994, p. 183). What will it take for us to seek new roads to run? Can we borrow some of Jesse Owens courage to fill our lungs, our hearts, our minds?

A Neutral Course

In spite of claims to the contrary, education is never neutral nor objective, but instead is the consequence of cultural and political bias. Scholars in the field of Curriculum Studies have been at the forefront of understanding and exposing the myth of neutrality in education. “Today, no serious curriculum scholar would advance the argument that schools in general and curriculum in particular are politically neutral” (W. F. Pinar et al., 2004, p. 244). Even before the public educational system was established, Thomas Jefferson weighed in with his proposal for a “public” educational system. He also believed that the success of the nation was dependent on education, and he believed that “there is a natural aristocracy among men. The grounds of this are virtue and talents...[which] I consider as the most precious gift of nature, for the instruction, the trusts, and government of society” (Jefferson, 1853, p. 396). Jefferson’s plan was to educate children for one to three years, then cull the top... “twenty of the best geniuses [boys] shall be raked from the rubbish annually.” (Jefferson in Nock, 1931). While the characterization of who is the elite has changed over time, the belief that there is a

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“natural aristocracy” is still embedded in the educational system. This idea, that there is someone whose knowledge is of more worth, is not new nor is it neutral.

Our current system of education as well as the very process of schooling still functions in the reproduction of hegemonic structures. The current system favors one course of study over another, one method of teaching, a peculiar hierarchy of valued institutions, of valued disciplines. Study guides show students what course to follow, making bold fonts for ideas that are deemed important, rather than letting them decide for themselves. Teachers are provided with foolproof books with guided questions and answers that require no thought on either participant’s part. Certain schools are privileged over others, based on a system of mostly unspoken but well understood aristocracy. A degree from Harvard...well ... is exactly that. The bias continues as we separate arts and sciences; we parse the sciences even further into “hard” science (chemistry, biology and physics) and “soft” science (social and behavioral). Though not all scientists agree with the delineation, the typical demarcation is the assumption that the hard sciences are quantitative and empirical data driven, while the soft are often mistakenly perceived as less difficult, dealing with subjective ideas and correlations. The prevailing hegemony often translates into who takes what courses. “Girls are less likely to take math and science courses ... even if they have a talent for them” (McLaren, 1989, p. 184). When funding disappears so do philosophy, music and art classes, slipping down the rungs of importance of valued knowledge. The decisions are not neutral; choices between philosophy and math—the “softer” philosophy is not available in high schools (with the exception of a few private schools) and is dwindling to a short ethics class in higher education. Decisions about K-12 textbooks are made in Texas, by a highly conservative

school board, limiting students' exposure to ideas deemed distasteful (will it include evolution?) And in every district, the decisions about which teachers will be hired (do they conform?), and which curriculum will ultimately be transmitted to the next generation. The outcomes are not neutral. Michael Apple clarifies the non-neutrality of the educational system in his recognition "that behind Spencer's famous question about 'What knowledge is of most worth?' there lies another even more contentious question, 'Whose knowledge is of most worth?'" (Apple, 1993, p. 46). Though the struggle for control of American curriculum has always been present (for overview see: (Kliebard, 2004; Spring, 2004) this century brings an unprecedented collaboration between business and government. We have seen through the work of educational scholars that knowledge is shaped, disseminated, and used under intensely political conditions. (Apple, 1993; Freire, 1972; Giroux, 2004). Educational systems reproduce and legitimate existing forms of political domination. "No curriculum, policy or program is ideologically or politically innocent, and the concept of curriculum is inextricably related to issues of social class, culture, gender and power" (McLaren, 1989, p. 184). Politics continue to play their role in keeping the arts and sciences separate, as each department is forced to be adversarial in defense of their "value." Value is suggested to include the benefit to the students, to the community, to society...but often the question is compressed to: "how does it benefit the institution"? Assigning values has the inherent function of tipping the balance of neutrality. Does brick and mortar weigh more than a student?

Curriculum theorists have been at the forefront of demonstrating the lack of neutrality in education. In this next section, I discuss the separation of the arts and

sciences. Separating art and science is not neutral either and the roots of this division are deep.

A Divided Course

The same cultural and political biases are culpable in the separation between arts and science. There are of course many other reasons; a primary one is that our knowledge has become so vast that we can hardly keep up with our own field of research. But in this chapter, I will discuss three main points. I begin with Descartes, since his first philosophy is often presented as the catalyst for our dualist ways. Secondly, I will briefly discuss the evolution of binary thinking and cognition. This is an important feature of our thinking process and may very well have destined us to a dualist fate. Our interpretation of early brain studies, may well add to our intransigence. Last, I broach the problem of the uncertainty of language...(sometimes a pipe is just a pipe, except when it is not). Maybe we can find a way to reconcile? How did we even come to have such a dualistic vision that makes us separate art and science?

Blame it on Descartes

Descartes did not have the benefit of our 21st century cognitive science in the mid-17th century. He was a product of his time. At the time, all science was fused with Christian doctrine. Claiming to be searching for a more complete understanding of God, Descartes' philosophical ponderings began with the exposition that all human beings have 'common sense' or 'reason' and where we differ is that "we guide our thoughts along different paths and do not think about the same things" (Rene Descartes, 2003, p.

5). Thus began his “search for truth” (p.6) and for something “that is not disputed and consequently doubtful” (p. 9) which he sees as a failure of previous philosophers. In his quest for a firmer foundation of knowledge, Descartes rejects Aristotelian empiricism (sensory knowledge) as fallible, since it comes from external observations. Descartes’ claim is that all knowledge must come through reason from inborn or innate ideas that have been revealed to humans by God. With this he sets in motion the paradigm shift that Thomas Kuhn (1996) recognizes as the making of a “scientific revolution.”

Descartes’ (2003) revolution begins with his conviction that he should be skeptical of everything, that in order to focus on the search for truth, he had to start by rejecting everything he knew to be false. Immediately, he ascertained,

...that while I thus wished to think that everything was false, it was necessarily the case that I, who was thinking this, was something. When I noticed that this truth ‘I think, therefore I am’ was so firm and certain...that I judged that I could accept it ...as the first principle of the philosophy for which I was searching. (p. 25)

From this one phrase, “*I think, therefore I am*” first uttered in French, “*Je pense, donc je suis*”, then in Latin, “*Cogito, ergo sum*”, Descartes derived the rest of his philosophy, including a “proof” of the existence of God. His ideas were more fully developed in his series of *Meditations on First Philosophy*. There, he divided reality into three parts: God, which must exist for all else to exist, *res cognitae* (consciousness, mind) and *res extensa* (matter, extension). It is in *Meditation II* that he continues to set the stage for mind and body dualism. He reiterates, “I am, I exist, is necessarily true whenever it is put forward by me or conceived in my mind” (1986, p. 17).

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He develops this thought in *Mediation VI* as he finally finds himself validated as two separate substances.

... I possess a distinct idea of body, in as far as it is only an extended and unthinking thing, it is certain that I, that is, my mind, by which I am what I am, is entirely and truly distinct from my body, and may exist without it. (René Descartes, 1986).

Descartes' idea was to present a unifying theory of knowledge. His thinking is clear and deliberate, as he applied his method of rigorous and systematic deductive reasoning and mathematical principles to make sense of the material world. His separation of physical realm and mental realm was deliberate; by separating science and philosophy (religion) he was able to avoid the politics of the church and do science without fear of retribution as he had seen happen to Galileo¹⁰. While Descartes' imagining of a disembodied mind no longer has any supporters, there are elements of dualist thinking still pervasive in today's modern society. Descartes' legacy is one of framing. He framed the body as separate from the mind (or soul as he sometimes says) and secondly he sets the body as simply a biological machine, with no free will. We still often frame the mind as an immaterial thinking substance, somehow not subject to the mechanical laws as is the body.

The dualism between mind and body persists in our consciousness and our language; we always distinguish between mind and heart. It is, in fact, not the way humans work out problems. "We are, and then we think..." (Damasio, 2005, p. 248). The

¹⁰ Galileo was imprisoned for the remainder of his life for postulating ideas antithetical to church doctrine.

neuroscientist Antonio Damasio points out that this is precisely the reverse of Descartes' statement. He proposes that before we were human, "beings were beings" (p. 248), and as we evolved, we developed a simple brain. Over time, our brains became more complex; we developed self-awareness, organized thinking and language to communicate. Even now, at this evolutionary stage, we develop into beings in our mother's womb, and then we begin to think. We do not exist without a body.

Blame it on Evolution

Even before the influence of Western philosophy, we have tended toward a dualist thinking. Opposites present themselves most dramatically. We can understand the difference between positive and negative, night and day, shadow and light, flight or fight, me and you, male and female, friend or foe, and even the more ambiguous right and wrong, though in most of these examples we see the necessity of a continuum of thought.

While I claim limited expertise in the arena of neuroscience, I suggest that dualism is hardly startling. The evolution of our neural pathways determined that we are hardwired to give a two-pronged response (Gazzaniga, 1992; Gregory & Zangwill, 1987; LeDoux, 1994, 2002; Pinker, 1997). Neuroscientist Joseph LeDoux (1996) tells us that visual stimulus is mediated via two neural pathways: one via the cortex, (cognition) and the other through the amygdala (emotional). Our emotional reaction is slightly (milliseconds) faster, so by the time we begin reasoning (should I stay or should I go); we already have a "feeling" about the situation or object. We see the bear either in its own skin or masquerading as clown or a dissertation committee member. The quick transmission of visual information "allows the brain to start to respond to possible

danger” (p. 17). Evolution provided us with a dynamic system involving complex physiologic responses coordinating neuroendocrine, cardiovascular, and musculoskeletal systems into action, to enable us to survive a threat. The brain triggers an emotive stimulus: our hearts pound, intestines contract, a push of adrenaline floods the bloodstream opening the arteries for maximum flow. This is a highly simplified explanation of decades of neurobiological research ideas by many dedicated researchers. But the point is, that the evolutionary process selected an instinctive system to protect us from danger and probable extinction. This cognitive process is certainly complex, but we tend to interpret it as binary—the reflex of flight or fight.

Left brain-right brain

Brain hemispheric asymmetry and laterality does exist, but the lay literature does this phenomenon a disservice by oversimplifying neurobiological sciences. Since famed physiologist Ivan Pavlov concluded nearly 100 years ago that humans could be divided into thinkers or artists, most references echo the same thing: the left-brain is formal and abstract while the right brain is more attuned to images and more artistic.

The main theme to emerge... is that there appear to be two modes of thinking, verbal and nonverbal, represented rather separately in left and right hemispheres respectively and that our education system, as well as science in general, tends to neglect the nonverbal form of intellect. What it comes down to is that modern society discriminates against the right hemisphere. (Sperry, 1973, p. 209)

But the reality is quite a bit more complex. Counter to popular understanding, Sperry has found that the right hemisphere is better at “concrete thinking, spatial

consciousness and comprehension of complex relationships” in addition to the ability to “recognize melodies and better distinguish voices and intonations” (Sperry, 1981). While Sperry’s work won the Nobel Prize, it is also important to note that his research and the resultant literature was based on the examination of patients who had the communication system (corpus callosum) between the two halves of the brain removed or severed. More recent work, using various types of neuroimaging, shows the intact brain using coordinated regions on *both* sides of the brain simultaneously, or in rapid fire “cross talk” in order to complete common tasks.

While there is some localized functioning in the brain, the two halves communicate and interact all the time. The result is, that even people who do not have well developed spatial consciousness can still become artists OR scientists; they will simply be a different artist or scientist than those who can think dimensionally. They merely find a different and more appropriate way (for them) of expressing their ideas. There is no real difference in brain functioning between an artist and a scientist.

Blame it on Language.

Language is a place of struggle.

(hooks, 1990, p. 145)

We cannot ignore language. It always implies hidden cultures, hidden concepts, hidden ideology and hidden politics. Since we have already entered the world of the circus, I reference the serio-comical genre (carnival) described by Bakhtin, which “has worked out an entire language of symbolic concretely symbolic sensuous forms...This language cannot be translated in any full or adequate way into a verbal language, and

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much less into a language of abstract concepts, but it is amenable to a certain transposition into a language of artistic images” (p.122). So in spite of its hard concreteness, there is still room for transposition, a recasting into another form. Perhaps it just requires a catalyst or a swing into the carnivalesque?

A carnival sense of the world is to Bakhtin (1984) a liberating thing, a “*joyful relativity*... [where] there is a weakening of its one-sided rhetorical seriousness, its rationality, its singular meaning, its dogmatism. This carnival sense of the world possesses a mighty life-creating and transforming power, an indestructible vitality” (124). Grabbing joyful relativity by the balloon string, we can soar above the dogma and be transformed.

The dogmatic boundaries that currently separate science and art ignore their common history. Once unified rituals and practices that served to explain the natural world. We have taken the work of shamans and we separated their tasks into distinct academic disciplines with definitive borders of expertise, knowledge and production. “Although the physical products of art and science may appear to be substantially different, if we view the ideas produced by each area as contributing to our personal languages and, eventually, our cultural languages or lexica, then these “fields” are, in fact, the same” (Garoian & Mathews, 1996, p. 193). The products of paintings, poetry, equations, and technological artifact in reality have a common origin. Each is a result of scientists and artists trying to find representations of worlds seen and unseen. Each is trying to find ways to translate symbolic understandings into in visual or verbal descriptions that embody the multivoicedness they feel.

The Language of Phrenology

Believing themselves scientists¹¹, early phrenologists thought they could explain the personality traits of humans by linking them to the topology of the skull. Each lump and bump was supposed to reflect personality traits, like consciousness, compatibility, secretiveness, and spirituality! These pseudo-scientists artistically displayed the tools of their trade hoping to entice folks to improve their minds and their characters, by a few simple exercises. The tools included polished brass calipers for measuring the skull, and several white marble skulls intricately labeled with areas of anger, benevolence, hope and wonder. Of course, phrenology has long been proven false, but some remnants of those past cultural prejudices remain today. We still say: “*He has a head for math*”; the French, more pointedly, say “*Il a la bosse des maths*” (he has the bump for math), which of course is a direct reference to phrenology. This type of language adds to the overall feeling that one is either a scientist OR an artist.

The Language of Each Craft

I looked for a quote that would open this segment. Something clear and concise that would frame the problem of the fractious nature of language. But that is exactly the problem; there is not a clear and concise frame for language. Bakhtin submits that “language is stratified...into languages that are socio-ideological...’professional’ and ‘generic’ languages, languages of generations” (Bakhtin, 1981a, pp. 271-272). Language either becomes so ambiguous or so specialized that communication is often thwarted. We

¹¹ There were certainly plenty of charlatans involved in the movement as well.

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think and speak with the instruments and the language provided by each discipline (math or color wheels) and as we specialize we find it difficult to communicate across borders.

This is not an treatise on language¹², but it is important to note the influence language has on how we perceive the world. Language is deeply linked to our emotions and experiences. Our beliefs, our culture, and our history, are expressed through language. Postmodern writer and semiotician Roland Barthes (1986) suggests that even on the “level of the simplest message, language (discourse) explodes, fragments, diverges” (p. 106). He stages language as a battleground, a war where “society transforms difference into conflict” (p. 106). Conflicts become more contentious and differences become more divisive as the language becomes exclusionary. The words keep flowing and changing meanings with time leaving us with infinite words and meanings. But I contend the division is really a chimera. We have created an imaginary monster with two heads, one speaking rationally and mathematically and the other in sensual emotional tones. Why are we trying to cut off one of her heads?

It is precisely this battleground I enter, knowing, along with Albert Einstein that in language there is always a struggle.

If two different authors use the words ‘red’, ‘hard’, or ‘disappointed’, no one doubts that they mean approximately the same thing... But in the case of words such as ‘place’ or ‘space’, whose relationship with psychological experience is

¹² For more in depth discussion on language and culture see (Beam, 1958; Chomsky, 2000; Heidegger, 1971; Kristeva, 1980; Lakoff, 1987; Pinker, 2000; Russell, 1966)

less direct, there exists a far-reaching uncertainty of interpretation. (Albert Einstein in Jammer, 1960, p. xiii)

Einstein recognized that there is uncertainty in language, some words that may defy definition, or mean different things in different contexts. There are a lot of historical, philosophical, and linguistic reasons to make us conceptualize art and science as very distinct and totally separated activities. But we can't throw our hands in the air in dismay. We must maintain the ability to navigate across borders of understanding.

There is Plenty of Blame to go Around.

"Those are my principles. If you don't like them, I have others."

Groucho Marx

While I have blamed where we are in interspecies relations of science and art on historical artifacts, evolution, and the words we use to communicate, it has not escaped my notice that there is still plenty of blame to go around. And politics plays a large role. Politicians and their conjoined lobbyists misuse science to advance their particular agenda. Distortions, misrepresentation, pseudo-science and anti-scientific lies are presented as valued information. The examples range from creationism represented as a scientific alternative to evolution, denials about climate change, and blaming natural disasters as an "edict" from God. We can also recall the past denials of the hazards of clear-cutting of forests, overfishing our oceans, tobacco use, asbestos, lead in paints, and the use of insecticides like DDT. Played out as a balance between "jobs" and "excessive regulations" our health and long-term wellbeing are the pawns in the game.

Reunification

Because readers come prepared with their unique understanding of what those words mean. I will use "art" and "science" in their broadest definition. My examples will come out of my own autobiography, focused on circus and science, but not ignoring other elements to the detriment of the discussion. My concern is that given the prevalence of science in society, in order for people to prosper and thrive in modern society, it is important for us to understand the conversation. Human values are affected by what we know about the world around us, this includes our understanding of science. Conversely human values change the way society interacts with scientific information. It also affects the way that science is done in this country. Science has always been politicized, which affects how we even talk about science; vaccine use and evolution are two of the more recent examples played out in the media. The development of vaccines, for example, follows basic scientific principles. Unfortunately there are those who do not recognize or understand the validity of decades of research and choose instead grasp on to pseudo scientific claims and anecdotes of disaster to foster fear about the process of vaccination, with unfortunate and deadly consequences.

In order for science to thrive as a positive participatory force in culture, society needs to appreciate and support the scientific enterprise. While some might argue that all our citizenry need not understand the detailed structure of molecules involved in an immunological response, we should understand what constitutes a strong immune system, and when we need to amplify it with vaccinations. The borders where science and society

meet are often an ideological battleground with both sides seeming to return to the Tower of Babel, with communication at an impasse.

Our desire to interact and communicate is at the very core of our humanity. Having a common language connects members of a community by having the ability to communicate ideas about shared cultural practices. We benefit from sharing our wisdom about sources of food and shelter, healing and medicine, marriage rituals, child rearing, teaching, arguing, loving and negotiating. We convey everything we understand about our lives and the tools we need for survival. And it goes beyond mere survival. We are lured to inquiry about what lies outside the borders of our community. We yearn to understand, compelled by curiosity or necessity. “The most important reason for the present separation of [art and science] has been a cultural and philosophical failure to recognize the common human origins and goals of each” (Garoian & Mathews, 1996, p. 193).

Art and science serve as the primary tools that we use to push the boundaries of our understanding of ourselves and of the world with which we interact. Both the sciences and the arts ask the same questions. Who are we? Where did we come from? What is my relationship to the cosmos? What is my relationship to others? Both allow us to tap into our imagination, our sense of originality and creativity, and our sense of wonder. Both art and science stem from an innate need to comprehend our surroundings and our relationship to those surroundings. Both stem from a desire to explore the world and express our ideas about how the world is. “Not only science but art also, shows us that reality, at first incomprehensible, gradually reveals itself, by the mutual relations that are inherent in things” (Mondrian, 1937, p. 353).

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Both art and science provide tools to explore our humanness, the sometimes incomprehensible reality. Science has brought us new ways of seeing from microscope to telescope, but art provides that same function. There is no better way to see the bestial madness of war except through the eyes of Picasso who chooses not to entertain us, but to do “hard” art, in *Guernica*, or in Ruben’s copy of Leonardo’s *The Struggle for the Standard*. Which is the better way of interpreting the roots of our emotions, a PET scan or the experience of Michelangelo’s *Pieta*? Which is the preferred way of knowing? Which one would you choose? Or should I choose for you? My point is that it is not, as some might suggest, an either/ or situation... we can choose both.

As an educator as well as an observer of my fellow travelers, I have been witness to a multitude of complex contexts within which people think. Suggest to people to think of “blue” and some will imagine the great open skies of Montana, some will feel sadness and melancholy, others envision the wavelength of light, or the rare blue of flowers in nature. Others may think of Wednesday or the number nine as does savant and synesthete Daniel Tammet¹³. The word with some context may change the knowing of it, but a “blue vase” may bring us joy in remembering a gift, or sadness at having broken it.

It is not just language, but perception as well. There are many examples of contextual seeing in the work of M.C. Escher, where water flows up in the context of some accompanying figures. There are several studies showing cultural differences in the perception of details in photographs between Asian and American subjects for example. There are cultures whose language brings more diversity to a subject, for example

¹³ For more on this phenomenon see (Tammet, 2006)

Yiddish has an amazing number of words for the term “simpleminded” (Pinker, 1997, p. 264). In my own science classroom, I learned to describe or draw molecules in at least three different ways. I had students that could “see” the structure one way, but they could not understand another representation, even when the drawings were placed side by side.

Ringside at the circus there are those who are wary or screamingly fearful at the appearance of a clown, while others will scream with delight in the encounter.

We are all awed at the sight of an elephant.

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AN ELEPHANT OF AN EDUCATION

Elephants are seen in many circuses around the world. Their size and grandeur insist that I move them from the back of the cavalcade and have them lead the parade. A historical beast of burden they are used to haul heavy equipment and wrest the enormous tent poles into position. Once relieved of Sherpa duties, they are placed in opposition to tiny sequined women who order the beasts to entertain us with their inhumanly human feats.

Whatever you do, do not think of an elephant.

George Lakoff

The female Asian elephant is an impressive sight, standing rock grey-brown in the early morning field, seemingly unconcerned with her surroundings, simply standing still, but for her trunk, which gently sways, a pendulum scattering the leaf debris in front of her. Asian elephants tend to be smaller than the African elephants, but still have an imposing weight of up to 12,000 pounds for males, with the females averaging somewhat less at 9,500 pounds. Comparisons and equivalents are difficult, as she is unparalleled as a land animal and surpassed in grandeur only by her taxonomically unrelated aquatic cousin, the whale. That she weighs the equivalent of 3 or 4 cars unfairly associates her a mechanistic quality and ignores her soft breath, and her calm composure. Her height ranges, up to 10 feet tall at the shoulder (the height of one aerialist standing on the shoulders of another), and her body length up to 11 feet, with a tail between 3 and 5 feet. These immense proportions belie her gentility of touch.

Her bearing is regal—that of a queen—dressed in inherited ancient grey leather, her hard spikes of hair, a softening adornment. Her trunk and ears freckled with pink Pollock splashes—a cloak—distinctive for each elephant in the herd. The female Asian elephant along with her male counterpart sport two cranial bumps as crown on their foreheads. While her brain is proportionately smaller than humans—it is still large relative to body size—a fact that speaks to the elephant’s reputed intelligence. She comports herself with dignity while displaying a wide range of emotions—grief, altruism, compassion, joy and humor. While scientists once thought tool-use defined human behavior, the elephant is quite adept at using tools—extending her trunk as one might use their arms—using twigs to clean her toenails or scratch an itch. Further proof of her intelligence, elephants have been seen demonstrating spontaneous insight—mentally determining how to use an object to solve a problem—moving an object to act as a stepstool to reach fruit above her grasp.

It was naturalist Carrolus Linnaeus, who in late 1700s was responsible for giving these animals Latin monikers. He divided the pachyderms into three distinct species *Loxodonta africana* called alternately the African bush elephant or African savanna elephant, the *Loxodonta cyclotis* or African forest elephant, and our *Elephas maximus*, the common name of Indian or Asian elephant, depending on continental habitat. Linnaeus instigated a scientific organization to categorize and provide taxonomic *names* for plants and animals using Latin roots that referred to distinctive features of each animal or plant. The standard-bearer of our story, the Asian elephant’s genus name, *Elaphas*, has an uncertain etymology, with alternating claims of origins of the Ancient Greek word for “ivory” or possibly simply directly from the Sanskrit name for elephant.

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The species name, from the Greek, *maximus*, translates easily to “greatest”, a simple acknowledgment of this largest of land animals. Linnaeus was a deeply religious man and a naturalist and felt a suitable gift to God would be to continue the job once assigned Adam who “gave names to all cattle, and to the fowl of the air, and to every beast of the field” (Genesis 2:20, King James Bible) which would reveal God’s order in the universe.



Like Linnaeus, I was drawn to science; comforted by the order and constancy I find in the universe. Unlike Linnaeus, I focus on the natural world and try to leave the supernatural to theologians. But as an educator in the Bible Belt—I feel obliged to deal with the Gods my students bring to class. They enter my science classroom in a real fear—certain that I will force them to give up their faith in religion and try to replace it with faith in science, or worse—evolution. Every semester we get off to an unsteady start. I want them to witness the wonder, challenge their perception of chaos in the natural world; instead they feel they are walking a tight wire. They are worried that they will be pushed from their platform of fundamentalist thinking while needing to move forward—through a certain ring of fire – toward the platform of evolutionary facts that will “get them through” this class. I am cast as ringmaster, with both whip and net.

If all we want from our public education is to get them through, then we are doing it well. The model we use based on our industrial revolution works as a quaint production paradigm, in one end and out the other. But, what if we want to do “s*** that matters” as creative insurgent John Bielenberg proposes? His idea is “to expose young creative people to the chance to shape a positive future in communities, and about things that they

actually cared about.” (Gordon, 2012). Like PieLab, which was developed out of Belenberg’s Project M initiative. PieLab is a rural Alabama eatery that seeks to bridge a racially segmented community together in a neutral space. Free pie and coffee are used to connect people and give them an opportunity to have a conversation. Who doesn’t love pie? We used the same approach with our little circus. The community had to come together to organize and decide on where and when and the how and wherefores of bringing the circus to town. With only a scant guidebook in hand, the participants had to come together to serve the community at large. Who doesn’t love the circus?

So how do we get to this different view of the elephant?

When the circus used to parade through the streets of small towns, we would crowd to the curbside and gasp as Salome perched high on the elephant’s back—her silks ablaze, floating on currents of air only felt at that altitude. Playful wafts of organza dazzled us, coloring our viewpoint. So skilled is her presentation we never see behind the veils, not even when she calls for a head to be sacrificed. Her identity is not apparent at first, perhaps obscured by a clever shroud of conservative concerns or liberal aspirations. What does she represent as the elephant of education struts through our communities? How do we get to what is veiled? To what must we attend? What is the point of our public education? What is the point of our community? What is the point of our existence?

Heidegger, (1927/2008) in his exploration of existence, says what we are witnessing is “...something that proximally and for the most part does not show itself at all: it is something that lies hidden, in contrast with that which proximally and for the

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most part does show itself” (p. 59). Heidegger explored the ideas of veiled understanding and what is “unconcealed” (his interpretation of the word ‘truth’) as we examine our being in the world, and that notion is important to consider as we examine the educational conundrum. Heidegger presents an interpretation of unveiling the truths as “removing the distortions of it that arise from the use of concepts inappropriate to [being]” (Dreyfus & Wrathall, 2005, p. 170). Is Salome unconcealing the truth as she reveals her being in the world? Or are we still left with an incomplete idea of what we care about?

Perhaps we need to close our eyes and see with different vision? Perhaps it is the proximity of the thing, as we feel the vibrations of the tonnage walking past that obscures our thinking. What is that heart center concordance that obscures the seeing, leaving only a sensation and no clear vision? “‘Seeing’ does not mean just perceiving with the bodily eyes, but neither does it mean pure non-sensory awareness of something” (Heidegger, 1927/2008, p. 187). My use of Heidegger is considered; while he is often difficult to understand as he turns old meanings on their head and invents neologisms, he did so deliberately. He felt “his task [as philosopher was] to provoke his readers to thoughtfulness rather than to provide them with a facile answer to a well defined problem” (Dreyfus & Wrathall, 2005, p. 1). Can we use this provocation as a source of curriculum? If we close our eyes and rely on thoughtfulness, will we see the world more clearly, will the veils fall away from our eyes, will we understand the curriculum of being in the world? Will we know Salome? Will we see the elephant?

The Blind Men and the Elephant

The question is not what you look at, but what you see.

Henry David Thoreau

An elephant's eyes are small relative to the huge size of the animal. They are about the same size as a human eye, usually dark brown, with upper and lower lids, and long downward swooping eyelashes that protect it from dust and debris. The eyes are located on either side of their heads—giving the elephants a wide visual field—although their eyesight is relatively poor. As their natural environment consists of various forest habitats, they see best in low light, with clear vision limited to 30-40 feet. As they forage in thick undergrowth they can withdraw their eyeballs under leathery eyelids that guard against injury.



There is an oft-cited narrative recalling a group of men seeking knowledge about an animal called an elephant, which none of them has seen, given that they are all blind. There are variations of this story found in many cultures including African, Indian, Chinese, Jainist, and Buddhist among others. After a lengthy search the men are guided to an elephant, where each of them approaches a different part. After touching the elephant, each person comes away knowing what an elephant is like. The man that touches the tail is certain of the elephant's rope-like qualities, the man who touches the leg insists the animal is like a tree, the man who touches the ear knows the animal is like a fan. The tusk is determined to be spear-like and the trunk decided as a very thick snake. The end of the tale leaves the men arguing bitterly about who really knows the truth.

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There seem to be two versions of the end of the tale (tail), the Jainist version ("Elephant and the blind men,") has the men combining their knowledge with the aid of an intermediary, with happiness for all as a result. Most other versions (Indian, Chinese, American) leave the men arguing bitterly about who really knows the "truth" (Yen, 2006). Leaving aside the issue of gender exclusion in all of these elephant tales, the lesson implied is that each of us is blind in our own way; each of us is holding a different, but our own truthful view of the elephant. These stories portray each man as being equally blind and yet having equal power and equal knowledge in the dialogue surrounding the animal. The balance is shifted to the harmonious in the Jainist version, as the egalitarian interlocutor brings everyone onto equal but now *shared* and happy footing.

Elephants on Parade

Policy makers are in the position to choose which message is significant. Politicians choose the costumed pachyderm to be trotted out for inspection. Debates that parallel the discussion of the elephant are seen across the American educational landscape. Though men and women of seemingly good conscience sometimes manage tempered cooperation, we see a propensity of discussions that ultimately degenerate into shouting matches and contentiously armed camps. Progressives and conservatives both lead the procession of elephants displaying the latest in fashionable costumes—no mere rhinestones but exotic gems of AYP, IEP, NCLB, SIG, RTTT, ESEA—in the spun sugar of sure fix programs, Unfortunately, they are blinded by their own piece of the elephant and the fight to retain that awkward view. Parades of ideas are tasted and then discarded

like cotton candy tubes, leaving only the sticky residue of political candy floss. What gets missed in the three-ring circus is the one of the real issues of education—how are we preparing ourselves for the challenges of an unimaginable future? We do not find all the shareholders in harmonious balance; instead, the curriculum becomes a fight for center ring and the right to brand the elephant. Complicating the landscape are rapid technological changes, a changing cultural climate and the disastrous financial fitness of school districts.

As administrators and politicians argue over the magic bullet that will fix all of this, the students remain trapped in the sites of an elephant gun of prescribed texts. These learners grab hold of the multi-colored highlighter pens as branches to hide behind. Grappling to decipher what is important in the text or, more significantly, what will the teacher consider test-worthy, the bolded words offer a handhold, but it seems these branches break too easily under their tight panicky grasp. Students come to office hours with their texts completely obscured by the rainbow of indecisions, and they have often forgotten the coding they themselves imposed. They self-identify as science illiterates saying, “I’ve never been good at science or math.” Most instructors will agree with them and sigh—repeating sections of the lecture verbatim—duplicating the experience of learning other foreign languages by having them restate, regurgitate, repeat—giving them clever acronyms or mnemonics for remembering. This limiting understanding of our students and our own teaching methods, fails to acknowledge anyone’s real-life experiences, and will maybe only succeed in getting them to pass the test. It is our understanding that gives us our “sight,” using Heidegger’s metaphor for intelligence. “Our intelligence, our capacity to make sense of things, lies in our

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understanding...[which] is fundamentally not a cognitive matter; it is a practical matter” (Blattner, 2006, p. 87).

But practical matters have a way of taking on a life of their own. In politicians latest practical attempt to improve education or perhaps just garner votes, Barack Obama unveiled the Race to the Top (R2T) as the successor to the Bush administration’s No Child Left Behind Policy. Claiming a split from the Bush era policies, Obama asked for flexibility “to teach with creativity and passion; to stop teaching to the test; and to replace teachers who just aren’t helping kids learn” (Obama, 2012). On the surface, this sounds great, but without ever using the word “test” the R2T program calls for “implementing rigorous standards and high-quality assessments... designed to measure critical knowledge and higher-order thinking skills” (“Promoting Innovation, Reform, and Excellence in America’s Public Schools,” 2012). A test by any other name...would smell the same.

We watch as Salomé or Mohini (a more dangerous transgendered enticer) imperious on the lead pachyderm. She mesmerizes us with sensual movement, as layers of silky political baffle-gab are suggestively (re)removed. As each acronymic veil, No Child Left Behind, Global Education Reform Movement, now Race to the Top, floats beguilingly by, we watch and attend. We think we know who she is. But who is that really behind the veil? How will she be unconcealed? As a nation we are seduced by the promise and deceived into believing we are the owners of truths and democracy. Yet, these politicians in a mockery of a drag performance are staking claim to any true ownership of power and knowledge. As Australian educator Susan Grieshaber tells us, in addition to regulation of compulsory education, the government has also taken over the

early childhood education forums. She claims that governmental agencies are “now responsible for the moral and social training of a major proportion of the child population, and by inference, the parent population” (Grieshaber, 2002, p. 166). Though she was looking at schooling as the “key technology of government” in Australia, schools in the United States are using the same testing, assessment, and accreditation strategies to reinforce the “dominant understanding of children, parents [and] staff” (p. 166). Those who have the least accountability are making the decisions about how students are taught. Even the local school boards are peopled with politicians who are focused on their immediate reelection needs and business leaders focused on proximate business orders. Decades away from any classrooms that are affected by the policies implemented, they cannot cast their eyes to the future. Indeed we have seen through the work of critical theorists and other philosophers that knowledge is shaped, disseminated, and used under intensely political conditions (Apple, 1993; Freire, 1972; Giroux, 2004). When the programs fail, we “replace teachers who just aren’t helping kids learn” (Obama, 2012). Learn what?

The US now spends billions of educational dollars on standardized testing. According to the National Board on Educational Testing and Public Policy the growth in test sales has grown by 50% in the last few years. Testing is not inherently wrong, and can be part of an overall assessment of how students are learning. But it is the Kaplan and Pearce Testing Services now determine what content should be covered, and not the educators. Testing has become the aim instead of part of the process. What is additionally alarming, though not surprising, is that this industry, which purports to be a service tool to US educators, is largely unregulated, and mainly free of educator involvement.

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Teachers are deskilled and become increasingly disillusioned. Who is designing these tests? Who is deciding what questions are important? Who is deciding that this is the best method of assessment? Since the teachers are all screaming “Foul!” who is behind this madness? Again, we caught a glimpse of Salome, who in the biblical tale, is murdered for trying to usurp the patriarchal power. Lowered into her coffin, the shroud is replaced, her identity concealed. Who is she? Who is in charge? Was she on our side all along or is she the autocrat?

The Heart of an Elephant

Educating the mind without educating the heart is no education at all.

Aristotle

The heart of an elephant weighs between 20-30 kg (40-60 pounds) and beats about 28 times a minute. A mouse heart weighs approximately 80-115 mg (0.004 ounces) and beats about 500 times a minute. The human heart weighs approximately 250-350 g (9-12 ounces) and beats on average 72 beats per minute. The human heart will beat approximately 2.5 billion times during an average life span.



Educators and scientists have been presenting science as an unerring body of irrefutable facts for so long, that they forget to talk about how science is done. So much of science is discovery, by observation and by trial and error (with a heavy emphasis on error). Every experiment is treated as test—a trial—with the researchers themselves looking for failure. Once the results are repeatable, there are still further questions—

another lab will be looking to dispute your claims, or they may be seeking to advance the understanding, albeit incrementally. In the classroom, we ask our students to formulate testable hypotheses from the facts we supply them with. In a professional science lab—the hypotheses sometimes springs from leaps of faith, based on a background of knowledge to be sure, but these leaps also depends on a surety of the heart. Still we teach science as if it were unassailable and complete. The illusion of complete knowledge “involves an erroneous belief in the omnipotence of reason” (O'Neill, 2004). Educators (particularly those in science) assure us that all we need to do is collect the facts and we can come up with a reason(able) answer; that we can know/prove the answer. In the different but related field of economics, neo-conservative Freidrick Hayek (1945) stated, “*If* we possess all the relevant information, *if* we can start out from a given system of preferences, and *if* we command complete knowledge of available means, the problem which remains is purely one of logic” The problem of course is the series of “ifs.” Are we really able to come up with all the relevant information? Who decides what is relevant about any elephant part?

In 12th grade, students are taught the path of blood flow through the human heart. The National Assessment Educational Progress (NAEP) then tests them on that knowledge. This test is purported to measure science literacy and the students ability to reason. The question presents them with 4 diagrams of a heart—a disembodied organ. Stripped of body context with a jumble of arrows pointing—so students hope—to the correct answer. Choose A, B, C, or D—a game of chance for most. Welcome to the midway! The barkers shout with delight! Games of chance! Try your luck! Choose the right set of arrows and it will point you the way to a better score! Our vampire test writer,

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who is a shadowy figure at best, and who may or may not have been a scientist or doctor, wrote this test without the path of reasoning, thus insuring a bloodless response. Is this what science literacy means?

Students can memorize the path of blood flow but still not come close to understand how the heart works (either physically or metaphysically). Is the feeling of a broken heart too unscientific for a science or medical curriculum? What of the lofty feeling in our heart as we witness the flight of an aerialist? We treat our students as passive, docile bodies, empty vessels—as if they have no context of their own. We hopefully imagine them to be waiting to be filled with Latin names and molecular weights—alternatively expecting those facts to be tossed in the trash at end of term—perhaps we all need a transfusion. Our students, long victims of the vampirism of institutional abuse—drained of any creative juices—are told what is important—we insist the only nourishment that is valid is from a teacher-expert. Keeping them on a barely sustainable life support—we tell them nothing of the bowerbirds hopeful preparations of intricate blue architecture that will entice a mate. Do not follow cupid's arrow—instead we tell them to follow disembodied arrows of a two dimensional heart and wonder why they fail.

Now we all want our students, scientists, and certainly our future doctors to have a complete understanding of the mechanics of anatomy and physiology. I definitely want my surgeon to know the direction of blood flow. After her decades of schooling, I want to take comfort that she understands the actions of my heart. But, I also hope for her understanding and compassion, an aspect of the heart she may not have discussed in biology class. I hope she will be patient with me as she guides me through what will be a

mechanical and surgical process for her, but a difficult emotional time for my family and me. Curriculum theorist, and educator Delese Wear (1994), working in the field of medical humanities, suggests that we might use stories to “weave us together as we crisscross with our shared experiences; help us feel connected to others as we live in our various ways the full range of human emotions; and reassure us that others have confronted the same difficulties we face” (p. 5). Where and when should we start our telling these stories? Perhaps my doctor, will hear the echo of other heartbreaks and let a story reach across time to soothe me. Perhaps, recalling stories about the compassion of elephants as they caress an injured tribe member with their trunks, she will smile and gently stroke my hand to reassure me as she explains the options for mending my broken heart, and how I will deal with the fear and the pain. Is there room in our curriculum for such an expansion on the discussion of disembodied blood flow? Recall Fleener’s (2002) invitation to put heart back into schooling as the reassertion “of meaning, purpose, value, and care as the driving forces of the curriculum” (p. 3). Can we bring care into the classroom? Educational philosopher Nel Noddings (1981/1999) thinks that this is an important consideration. She suggests that, “what is most valuable in the teaching-learning relationship cannot be specified...[but] the attitude characteristic of caring comes through in acquaintance” (p. 47). I agree. We cannot separate the encounters in which we engage from the content of that engagement. How we feel is the context of what we know. We are measuring our children’s success based on a Cartesian view of the mind and body, and they are failing...we are failing. The disembodied, mechanistic, and illustrated heart must be reunited with the mind and the body.

Only 20.46% of the students taking the test answered the question correctly, which was rated 'hard'. But my guess is that far fewer of them cared.

Elephant Training

Morality which depends upon the helplessness of a man or woman has not much to recommend it.

Mohandas Gandhi

As a training technique, young elephants are chained to large stakes driven deep into the ground. They pull and yank and strain and struggle, but the chain is too strong, the stake too rooted. One day they give up, having learned that they cannot pull free, and from that day forward they can be "chained" with a slender rope.

When this enormous animal feels any resistance, though it has the strength to pull the whole circus tent over, it stops trying. Because it believes it cannot, it cannot.

(de Becker, 1997, p. 276; p. 47)

In Southeast Asia, the training process differs slightly, and begins by penning them in a tight cage made from heavy timbers. Their movement is tightly restricted until they finally stop struggling.

Our public and private schools, also provide society with behavior adjustment training. Not unlike the training of circus elephants, we demand that our children defer to the authority of the stake/ state using the principle of "learned helplessness." We tie our students to their desks in cinderblock rooms, until they become the "docile bodies"

(Foucault, 1977) we aim to control. Children have to precisely perform the rituals that

define the culture of school. Children must be able to perform correctly the series of strict policies that guide the behavior of the students: line up, file in quietly, take your seats, sit quietly, take out your pencils, and begin the regurgitation rite! This militaristic ritual has some variations, but the children are generally not allowed the luxury of divergence. The typical middle school class schedule consists of six or seven classes of 45-58 minutes in length. “Students almost never had more than 4 minutes between periods to access their lockers or go to the restroom” (Mattox, Hancock, & Quee, 2005). When children are incapable of sitting still for the requisite class period (which extends to 90 minutes for block scheduling), teachers and administrators label them as disruptive—Ritalin will control that.



When my stepson came to live with us, he was lively, intelligent, and thoughtful—and he was a teenager. To assist him in his transition from another school system, I spoke with his old principal to get an idea of his academic record as well as any other insights he might have. I learned that, “While he decided not to participate in sport this year, he seems much quieter, more compliant to the rules of the school. We really think that putting him on Ritalin was an overall effective idea.” Michael and I sat down as parents to evaluate the news. His life was in turmoil: new school, new parenting, new city, new life—but he still just acting like a teenager, or at least all the teens we knew or *were*. With the diagnosis of ADD, should we let him ride the rollercoaster of hormones with those perilously steep angst-ridden learning curves of adolescence? Or should we protect him from the worst of it—help him focus in his studies—by providing a leavening

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agent? Should he have to feel the chaos of emotions—the brutal reality of how we are? Or, is it truly better living through chemistry?

This is a tough call for parents. The school culture which requires long periods of sitting still—aided by the pharmaceutical companies' marketing campaigns are telling us that *different* thinking or acting can be and *should* be cured with a simple little pill—most commonly Ritalin and Adderall. And why shouldn't Big PhRMA (Pharmaceutical Research and Manufacturers of America) “join the fast food industry and other corporations in their push to turn schools into profitable markets” (J. Weaver, 2010, p. 50).

Rather than changing the way schooling occurs for those who can not sit still—the advice to put your child on prescription drugs is doled out in spite of the fact that numerous studies reveal that the drugs prescribed for ADD and ADHD are at best ineffective and at worst rewiring the structure of the people's brains. Atlanta pediatrician Dr. Anderson puts it this way, “We've decided as a society that it's too expensive to modify the kid's environment. So we have to modify the kid” (Schwarz, 2012).

As if in a *Brave New World*, we are using the equivalent of Huxley's narcotizing “soma” rather than accommodate our children's different behaviors. We are educating students and parents and teachers to believe that variation in cognitive abilities, learning styles, and performance are all factors that should not be tolerated. In some cases we insist that children receive—as daily sacrament—drugs with the same chemical structure, same chemical properties, and same addictive qualities as cocaine. “Their brains have become a market niche for pharmaceuticals and their bodies the new home for a little pill that removes the spirit but helps them pass a test” (J. Weaver, 2010, p. 50). Cocaine is

vilified while Ritalin is the remedy. Ignoring the elephant in the room, it appears as if Fellini has taken over, amplifying the multi-ringed circus atmosphere of dystopia. The aporia is prescribed and the children are all sitting still.

There is an Elephant in my Bed

One morning I shot an elephant in my pajamas. How he got into my pajamas I'll never know.

Groucho Marx

We are in bed with an elephant, and ignore it at our peril. In addition to prescription drugs, curricular activities and describing what constitutes success, what is also troubling is the now inseparable nature of government and big business interests. This incestuous paradigm supplants the important tradition of “American public education [that] has been providing students with the critical capacities, knowledge, and values that enable them to become active citizens striving to build stronger democratic society” (Giroux, 2000, p. 83). Though the struggle for control of American curriculum has always been present (for overview see: (Kliebard, 2004; Spring, 2004), this century brings an unprecedented collaboration between business and government in the building of character building cages. Rather than educating actively democratic citizens, our schools are training passive consumers.

With full support of many school administrators, Coca-Cola, PepsiCo, McDonalds, Disney and other big business begin their campaign of “behavior adjustment” by tying prominent product placement to their gifts of money and product to

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schools. Even educators opposed to such strong-arm commercialization are well schooled in learned helplessness; there is nothing else that can be done, the money and materials are needed “for the children.” (This understates the complexity of educators being held accountable by administrators to adhere to the desires of the board, an issue not covered in this essay.) All the while these acts of advertising are lauded in the media as charitable endeavors that are claimed as tax-deductible philanthropy. For example, in a news release, California State University in Northridge announced a \$1 million gift by Wells Fargo recently made to their education school. The president of the University is suggesting they rename the small business center in honor of the gift (“Wells Fargo Gift,” 2003). Wells Fargo’s branding of the public building cost them less than three 30-second spots on television. Not only are schools easy prey, but they sell themselves cheap. This is permanent, laudable, and tax deductible.

Public school classrooms come equipped with enough brand names to fill a shopping center. “Culture, supported by mass media, is used to foster a commodity perspective and to teach people how to consume, making consumption seem like a natural and necessary part of life” (Kasturi, 2002, p. 50). No longer are mathematic work sheets about counting innocuous items like apples and oranges, but instead we are asking students to count Skittles candies or Hershey bars. Cafeterias have been replaced with food courts branded by McDonalds and Taco Bell. Schools who have accepted Channel One or ZapMe technology gifts subject our children to advertising for sneakers, colas, and breakfast cereal. If students haven’t been confined to wearing uniforms, they arrive plastered with Nike, Armani, Fubu, and Gap tee shirts offering free advertising for those corporations. (For a more in depth discussion on corporate culture and schools see Giroux

2004). The free flow of brands normalizes and standardizes the consumption as a necessary and natural message.

Not only are schools teaching students the consumer culture, in an expansion of branding innovations, whole theme parks designed for education and entertainment are reifying the branding as culture. The prototype for this new “branding bonanza” is a park called Kidzania, in Japan. According to Advertising Age “young customers are outfitted in uniforms, hats or helmets as they take up their places in child-sized brand venues ranging from a Coca-Cola bottling plant and a Mo's Gourmet Hamburgers restaurant to a Johnson & Johnson hospital ward and a Mitsubishi auto world” (Lindstrom, 2007). In an expansion of take your child to work day, themed entertainment is now tapping into the *edutainment* market with a branded experience of learning how to be an adult. As parents send their children in these edutainment training camps, the not so subtle message is one of selecting the “right” career brand.

The involvement of business in education is not all bad. Certainly the students of Cal State Northridge will benefit from the scholarships provided by their sponsors. The expanded facilities will allow students to study and work in a comfortable environment with a Starbucks in hand while taking a break from their studies with “a pause that refreshes.” But, while admiring new facilities and scholarship monies, we must also pay attention when we get into bed with elephants.

They may just roll over on you.

Elephant Texts

elephant | 'eləfənt|: *A size of paper, ranging from 20 X 27 to 23 X 30 (Webster's Dictionary, 1966)*

Elephant family structure provides not only a defense against predators, but offers a social environment in which young elephants learn. Babies are born with limited innate knowledge or skills, even learning to use their trunks by imitating the older members of the herd. “The activity of covering oneself with water, sand or mud is not instinctual but part of an elephant’s education” (Denis-Hout & Denis-Hout, 2003, p. 214).



In the discourse on education, the lessons learned, the lessons presented, and resented are varied. Education begins as soon as we are born. Even elephants are subject to lessons by their mother. The curriculum is multilayered, subtle in its presentation. Elephants and humans both first learn that we are loved and where the food is. And, depending on your parent, whether mud is an option. Lessons increase as we learn the dangers of traffic, lions, hot stoves, and the playground hazards of skinned knees and bullies. We learn about cooperation, and selfishness, responsibility, and fun. All this happens before we step foot into a classroom.

When I first started public school, I really did not like it, preferring instead to hang out at a fire station that was on the route to school. In the classroom, I was taught to color within the lines, trees are always green, NOT the complementary and more magical color purple. I suppose this is where I rankled. As I moved through the process the books got heavier and the lessons now contained the social and political

constructions of my parents' era. These women and men had fought against their generational "axis of evil" (Hitler, Mussolini, Stalin) and for the concepts of democracy and freedom. The curriculum here was also multilayered, but not so subtle, designed to help my fellow students and I to fit into the perceived and preserved, codified model of American culture. The texts I stored in my locker (an item now deemed too dangerous for today's public schools) were designed for an efficient transfer of the official knowledge of war, politics, and patriotism (a veritable zoo of hawks, doves, donkeys, and elephants), science, and civic values.

I do not remember where or precisely when I learned about elephants, but it was no doubt a combination of texts writ large. I had picture books, story books, encyclopedias; I'd seen cartoons on television; I'd been to the zoo and to the circus. So my understanding of an elephant was formed after approaching it from several angles. Texts now arrive in more varied formats. They are delivered as video streams, online lectures, and PowerPoint presentations, Twitters and Tweets, Facebook pages devoted to just one elephant, chats, and discussion groups, or podcasts to be viewed/ heard/ learned?) at leisure.

In an early version of the media approach to education, *Classics Illustrated* brought classic literature into graphic or comic book format. Though the format had critics, they were an attempt to steer kids away from typical comic books and by using "the language of the enemy" designed to get children interested in reading more "worthwhile" material.

In a recent expansion of this form of visual literature, Art Spiegelman (1991) challenges the standard delivery of historical narrative in his Pulitzer Prize winning

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Maus: A survivor's tale. He uses neither comic style (implying funny) nor the graphic novel (implying fiction); as he prefers to define his style as “commix, [(though co-mix might be more explanatory) as in] ...mixing together words and pictures to tell a story” (Spiegelman in Young, 2000, p. 14). In Spiegelman’s commix style the words and pictures are given equal value in the mix, giving his work a synergistic alchemy. This is a break from the standard educational delivery using texts defining history as a linear process with punctuated past, present, and future interspersed by images. Standard history texts suggest the past is over; Spiegelman reminds us that past-present-future are co-mixed.

Heartened by Spiegelman’s groundbreaking work other writers/ artists have entered the forum (Sacco, 2002; Satrapi, 2003). In the same way comics change the curricular discourse on history, other sequential artists are changing the way that science is taught. As one might imagine, this has produced a stampede of criticism from scientists and science educators. Professor Carol Tilley, from the Department of Library and Information Science, at the University of Illinois says, "Although they've long embraced picture books as appropriate children's literature, many adults – even teachers and librarians who willingly add comics to their collections – are too quick to dismiss the suitability of comics as texts” (Alleyne, 2009). The discomfort with this type of presentation proposes that it is invalid or inappropriate representation of the story, be it history or science. In a discussion with a colleague, an articulate and astute woman, she uncharacteristically dismissed this work with inarticulate finality. She had few words for how disturbing she found Spiegelman’s work, just that it was “wrong.” But what is the

correct voice/art/write/presentation of complex issues? Should we just “not have any more stories (Spiegelman, 1992, p. 45)” or do we just want them in the *correct* format?

Every new idea, every new medium, every new scientific advance comes under scrutiny. In science classrooms, calculators replaced the slide rule with the apprehension that students wouldn't have the foundational skills to build on. And our way of learning about the world is shifting. The media is changing with alarming speed. How can we keep up? And more importantly, should we? The conversation about comics has been supplanted with the idea that every student should or should not be working with electronic textbook. But where do we put our resources? What if we can't figure out the new technology? Should we replace the PowerPoint slides? Let's buy the whiteboard technology? Should we get more clickers? We are falling behind! What about that new testing system? If we just get the latest greatest...I know this will translate to student success!

We find ourselves looking up at the toes of an elephant, the only place where the animal sweats.

Elephant Trunks

You need a trunk.

Lorenzo Pickle to Willie the Clown

I had the good fortune to commune with elephants. To be examined by an elephant's trunk is a supreme joy. I was in Thailand, when I first met Maja, an Asian elephant. In our initial encounter she investigated me thoroughly with her trunk, sniffing

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and snaking tenderly, teasingly, around my whole body and ending with the basket in my hands that contained hands of bananas, cabbages, and melons. Like all highly social animals, elephants have a well-developed system of communication. She uses her trunk in greetings, caressing gently, or when needed—as raised and trumpeting warning. It is her organ of communication.

Though she could have easily plucked the whole basket from my hand, she waited patiently for me to put huge handfuls into her soft and sensually fleshy mouth, aiding my initially tentative placement with her trunk. Strong and flexible both, her trunk, remains an appendage of wonder. Formed as a combination of her upper lip and nose, it is a highly sensitive organ containing over 40,000 muscles. The complexity of the muscle system provides her with the dexterity to grasp a single seed with the “finger” at its tip, and the strength to uproot a tree with a seemingly modest tug. Used as the primary sensory organ, aside from her ears, the trunk is used to smell for food, to search for signs of impending danger, or to determine the sexual readiness of a prospective partner. While she breathes through her trunk, and sometimes uses it as a snorkel while swimming, she does not use it to drink, using it instead as a siphon to transfer water into her mouth, or to playfully dowse you when your back is turned.

Curriculum is an elephant’s trunk. It is soft and sensual, embracing alternative viewpoints, and welcoming novel ideas. It is strong enough to carry the visionary ideas into the future, by allowing us to unpack the ideas of what makes education a valued principle, and flexible enough to be a transforming agent.

Can we as educators bring the metaphor of the elephant to bear on our thinking? Where do we as educators position ourselves to allow children and adults to think freely

about the world? In examining different texts, media, and modes of communication we see hierarchical patterns of power and politics; we also see women and men challenging the normative party lines, and replacing them with truths of their own. Does it matter which end of the elephant we examine first? Which part or combination of parts will reveal the whole truth? “We are faced with the problem not only of what we can know but also of what we are to do” (Caputo, 1987, p. 236).

What do we *do* as educators to help students gain their own sense of being as Heidegger might define it? To find their own way of thinking? To find their own way of being in the world? How do we begin to craft a dialog about the “constellation of difficulties” surrounding being here/there, as in Heidegger’s *Dasein*? As I understand it, *Dasein* is what it means for you to be you. For you to attend to your being in the world. “*Dasein* is lured into complacency with the public interpretation of things...preoccupied with the concerns of the present moment...tranquilized by what is actual and subverted from the possible, understanding is lured into a reading of the world in terms of actuality and presence, the always available stuff of things” (Caputo, 1987, p. 62). Isn’t it easier to respond to the day to day onslaught of insistence that this dress, dish soap or deodorant will make us more popular or beautiful. Can’t the tranquilizer of “retail therapy” remove our preoccupations of answer to racism, classism and all the other “isms” too big to confront in our curriculum? Don’t we want to be lured into contentment by the always available stuff of things?

Who can blame us as we all fall easily into complacency, anaesthetized from constant thoughtfulness, perhaps overwhelmed by mind-numbing jobs or even joblessness caused by seemingly random or uncontrollable events like down-sizing,

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corporate greed, or simple incompetence? Isn't it easier to look askance at the leaving of elephants and just be grateful that it wasn't us that stepped in it?

Or is it our responsibility to change the conversation to one of inclusiveness, egalitarianism, and real democracy. Perhaps we must employ our trunks to wrest our charges from complacency, to sound the alarm, to prevent them from forgetting the curved past-present-future nature of life and knowledge. Perhaps we need to change the interpretation of the nature of things by “reversing the drift, by swimming against the stream” (p. 62). Maybe we need a trunk. Perhaps we need to become the elephant, swim in the stream, our trunks proudly held high so we can breathe in the onslaught of turbulent water.

Conclusion: The Elephant's Tail

I'm afraid we felt the wrong end of the elephant first.

Alan Wagner

This is what it comes down to. There is a principle known as “emergent properties.” Essentially, it is the process of coming into being. Philosophically, emergence recognizes the whole as greater than the sum of its parts; new properties emerge as individual parts interact with one another. For example, individual cells have increased function if they are acting in concert—as a heart. Extended further, we humans are more than a collection of body parts, our emergent property—our humanity. I bring this up to return to the story of our blind men all of whom have knowledge of an organism, all of whom bring a unique perspective to the conversation. Which man, which

woman brings the most to the discussion? Where do we as educators position ourselves to allow children and adults to think freely about the world? In examining different texts, media, and modes of communication—different parts of the elephant—we can examine the emergent properties—the hierarchical patterns of power and politics; we also see women and men challenging normative party lines, and replacing them with truths of their own. Maybe curriculum is the elephant? In which case, does it matter which end of the elephant we examine first? Perhaps gathering together in communities as a way of assembling all the bits together we can begin interconnecting and reimagining some creative views of elephants and education, and keep our feet out of the droppings.



Figure 2: The author on one of the better elephants she has known. From the collection of the author.

CHAPTER 3

CURRICULUM RINGS

The special characteristic of the circus is that one is creating and living at the same time, without having to keep inside fixed bounds... one is constantly involved in action.

(Fellini in Budgen, 1966, p. 90)

Art is not a mirror held up to reality, but a hammer with which to shape it.

Berthold Brecht

This Chapter will present the metaphor of the circus as a space of for communication and the polymerization of ideas. The notion of circus arts is a way to engage a more democratic and dialogic curriculum. Circus as a specific form of theatre is fore fronted for its ability to “cross boundaries that confine other forms of art and entertainment and, in crossing those boundaries, enter life and transform individual lives” (Stoddart, 2002, p. 61).

Circus can offer a dynamic dialogue allowing us to incorporate ideas that are important in the realms of science, art, and curriculum. “Circus itself serves as vehicles for a nostalgic spectacle of an exotic world that reformulates nature and culture” (Little, 2006).

Maxine Greene (1997) laments “the all-too-familiar dismissal of the arts, as if they are frills, as if they do not matter, as if they were not central to our understanding of the culture and of ourselves” (p. 33). I attempt here, to stage a new production, to fill the house with curriculum. Circus is a social construction, so it is suitable to fill it with

people and ideas. It is a collaborative art in which people write, produce, and perform stories that are of concern in the public arena. Circus reflects the concerns of the every day, because its essence is that of “creating and living at the same time” (Fellini in Stoddart, 2002, p. 47). Aerialists are in love and fill their act with temptations; jugglers fight and bring their passions to the ring, imitating battles, and doing politics. The acrobats vie for power, while the clowns act out comedies and tragedies both, each reflecting specific paradigms of our culture. As performers do culture, their curriculum includes the sciences of biology and physics, chemistry and history. Circus lends itself to otherness, as circus folk move within normal society, but are held to a different standard. We can say the same of scientists and of curriculum theorists.

The circus of science, however, is not a sold out show; in fact, the house is filled with just a sprinkling of stereotypes. All dressed in white lab jackets, squinting through bifocal glasses, the audience is ready to go back to the lab to “cure” something. Science as it is expected to be presented in the classroom and in the commons is often un-engaging, unrelenting, and unsatisfactory for all participants, teachers and learners alike. The information bears little relationship to the biological and inherently scientific organisms in the room, having been stripped of its humanity. Discrete, disconnected, disinteresting facts are disseminated and distributed and attributed to the appropriate (too often) white male scientist and repeated and regurgitated to the dissatisfaction of all involved. Educational theorist and cultural critic James Macdonald (1995) warns that we are living in a dictatorship and schools are developing a tyranny of knowledge. Our insistence that we impose a curriculum of “separately strung beads with no attempt to

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relate them to each other” (p.41) means we “are being subjugated by the very process which is intended to free us” (p. 40).

If we are to consider a reformulation of the nature and culture of education, I suggest that “dialogue” should be placed on the endangered species list of many classrooms, with the invasive species “monologue” having replaced the wild(er)¹⁴ type. Though monologues have their role in circus, with each performer taking the center ring, it runs counter to the democratic ideas necessary to create a successful show. In a classroom the monologue leaves no room for educational enrichment or advancement and serves only to alienate and irk. As a curriculum theorist and sometimes educator I concur with Paulo Freire (1972), when he states that dialogue is, “an existential necessity ... addressed to the world which is to be transformed and humanized [and to be systematically named]” (p. 77). An inherent human phenomenon, dialogue is what is necessary “to exist ... to *name* the world, to change it” (p. 76). As a curriculum theorist, I cling to the ideas of education and curriculum as humanizing, liberating, and alternatively demanding agents of change.

But science has taken on the role of naming the world, and reshaping the world in a new likeness. Friedrich Nietzsche (1882/1974) realized “that what things *are called* is incomparably more important than what they are” (p. 121). Nietzsche artfully imagined reshaping the world into new likeness, in a twist on the interpretation of the laws of

¹⁴ In science studies “wild type” (WT) is the typical form of a species, gene, or characteristic found in abundance in the natural world. WT is also used to define the species, gene or model system as an antagonist (though usually not described as such) against which aberrations or mutations are measured.

thermodynamics¹⁵. He recognized that in order to destroy “old names and estimations and probabilities” (p.122) we must change them by becoming the *creators* of new things. By naming things anew, or framing things differently, they take on a new identity.

Increasingly conversation is suppressed and replaced by one-sided pronouncements that declare that science has *named* a new drug to cure our restless legs and restless minds. The scripts provided offer despair (of dis-ease), hope (for a cure), anguish (waiting for results) and finally a happy ending (a good night’s sleep and a cellulite-free body). Life has been framed as something to be cured. Lacking the aesthetic pleasures of Shakespeare’s *Midsummer circus*, with its interlocking plots, instead the text offers a simple riveting *tele-novella* moment.

Jung (1916) suggests that “[f]rom the viewpoint of analytic psychology, the theatre, aside from any [a]esthetic value, may be considered as an institution for the treatment of the mass complex” (p. 43). In other words, the theatre we present—whether on a bare stage or a circus venue—generates in us empathy as we recognize ourselves in the theatrics, allowing us to see more compassionately. Jung posits that theatre, which he saw as an “imitation of real life” (p. 334) can help us move away from the “mass complex” which we might equate most simply as “our own shadow (the dark side of our nature)” (C. G. Jung & von Franz, 1964, p. 73). Recognizing ourselves in the theatre moves us away from the danger of projecting the dark side of our nature onto others. It moves us away from that dangerous lock step thinking (mass complex) that is used to prop up political polemics, or religious, racial, and ethnic suspicion and hatred.

¹⁵ Energy or matter can be changed from one form to another, but not destroyed.

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So we see that naming can be a double-edged sword. On the one hand we are able to create new meanings, think with renewed vigor and creativity. But when we find ourselves in a venue where others or we ourselves produce monologic pronouncements as the only mode of communication we are no longer in a curricular space—we are outside the tent—excluded.

Science can often seem to be a discipline of exclusion. Paradoxically, by trying to make the world more understandable, everything is framed by virtue of naming something “this” and not “that”, we exclude other possibilities. Perhaps it is this very the naming nature of that creates the climate of exclusivity. In such a climate, should science alone define our relationship to the physical and natural world around us? Is there a scientifically measurable connectedness to all things in the tangible world? What of the intangible? If we cannot measure or mathematize or categorize it, does it lose its significance? The reduction to simplistic recounting of objective facts and diagrams are considered useful tools for scientific literacy. High scores on fact checking tests also reassure us as indicators of our own success as educators. But this approach negates the essence of a whole natural world.

Science is one of several instruments of human culture that arose in response to the situation we humans have found ourselves in since prehistoric times: We, who can dream of infinite time and space, of the infinitely beautiful and the infinitely good, find ourselves embedded in several worlds: the physical world, the social world, the imaginative world, and the spiritual world. (Smolin, 2006, p. 297)

Smolin is a theoretical physicist specializing in loop quantum gravity. He reminds us that science is *only* one of several tools we can use to name the world. We have other

tools, and we need to enlist them as a method to examine the world around us. If we do not enlist new tools, how will we understand our role within world, let alone within the content of the syllabus? As biologic and scientific organisms, how do we include the issues of power, class, race, gender, sexuality, and democracy that are inexorably intertwined in matters of the natural world? How do we bring these concepts into the discussion? How do we loop some of these naturally complex issues back in to the curriculum; “how do material and symbolic threads interweave in the fabric of late twentieth-century nature for industrial people” (Haraway, 1989b, p. 1)? We still suffer from Kant’s legacy of separating disciplines into neat little boxes with metal sides and now rusty locks. So perhaps we need to break out the crowbars and make the subject more accessible by intertwining science and science fiction as Haraway suggests?

Though under discussion for two decades, we are still left with the question of how we remove the obstacles of mystique, measurability and the memorizable while opening the space to reveal and allow us to revel in the magic and mystery and myth of science? Philosopher Gaston Bachelard (1938/2002) suggests, “the problem of scientific knowledge must be posed in terms of obstacles...[and] opinion is the first obstacle that has to be surmounted” (pp. 24-25). Bachelard, as philosopher and poet, a dreamer of reveries falls into the category of a soft scientist. He is a weaver of material and symbolic threads. He writes of an ontology that thrives on imagination rather than just pure reason. In his dedication to understanding of science, Bachelard, intertwined the hard nature of intellectual rigor with the while reveling in the soft sensuous nature of the elements. He caresses fire, water, air, and earth, which in turn reward him by revealing their natures. In his search to understand the nature of scientific modes of thought, Bachelard shows us

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that the battle to surmount opinion, to remain objective, is hard fought and rarely if ever won, by scientists or educators. Why are we stuck in this antiquated framework of scientific teaching? While Bachelard serenades us with poetry, can we use Brecht's art to hammer our way out of the clown car? Can we engage the circus as a staging ground for new conversations?

The People's Theatre

I regard the theatre as the greatest of all art forms, the most immediate way in which a human being can share with another the sense of what it is to be a human being.

Oscar Wilde

The circus—often called the “peoples’ theatre”—like philosophy, often sheds a light on different and difficult realities. It is, as Oscar Wilde declares, a most marvelous way of sharing our humanness. So to look at circus, this most excellent form of theater, we can borrow some of the elements to inform the curriculum of culture. Using the same basic elements of theatre, circus has a script (though this is loosely defined), performance, performers, and the audience as the minimum definition; circus can construct an amazing range of experiences, a reflection of life. So much more than simple experience, Vaclav Havel (1990) says that theater is “something more: a living spiritual and intellectual focus, a place for social self-awareness, a vanishing point where all the lines of force of the age meet, a seismograph of the times, a space, an area of freedom, an instrument of human liberation” (p. 40).

Circus, as a special form of theatre promulgates those same ideals. It is clear that circus can be used as an “instrument of human liberation”, and insists that educators incorporate it into the curriculum. It is an extraordinary concept—to find a place so outside ourselves that allows us to believe that we can fly, or leap, or dance on a wire—a place that still embodies a place of social self-awareness—a place that allows us to move beyond a single-story narrative. The notion of human liberation is something Havel is well positioned to elucidate. A lifelong political activist, Havel wrote plays and essays which were instrumental in moving his country toward the “Velvet Revolution”, a peaceful expression of the peoples’ discontent with their communist leaders. An unintended consequence of his activism he was the pushed by citizens into the role of the first President of the Czech Republic (1993-2003).

What we as educators can emulate is Havel’s use of theatre to transform complacency into activism. Teaching is and should be a form of activism. “And if our teaching is related to our work as scholars—as it should be—our students might learn not only subject matter and core competencies, but—more importantly—learn the crucial importance of intellectual exploration and creativity” (Morris, 2006, p. 6). What Morris points out here is that creativity and intellectual exploration is *vital* as an educational legacy. This requires that we educators emulate Havel’s commitment to bring to his fellow humans into this space for “social self-awareness” whether we are presenting history or English or science. We can help our people to find their own liberties to engage in intellectual exchange and creative thought. This concept of self awareness is of particular importance, for no matter how interesting we try to make a lecture, no matter how many visual aids we provide, no matter how many facts are bullet-pointed, there is

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no way to accurately place our students into the very nature from which they have become isolated. Somewhere, in some space, we have to let the students to come to their own sense of social self-awareness, their own sense of obligation and responsibility to their community, writ large on the planet that nurtures them.

While we can bring a sense of intellectual focus and social awareness to the discussions of nature, we must keep in mind that “theatre [and its special sister, circus] should always be somewhat suspect” (Havel, 1990, p. 41). Havel’s use of the term “suspect” reminds us that what is being presented on any stage, any screen, any space, any classroom may not be the truth, or the only truth, or only a portion of the truth. In fact, what we are presenting may be a purely fiction in the smiling ringmaster’s guise of truth. Fiction in science?

Recalling Haraway’s premise of interweaving suggests that this idea may not be so outlandish and in fact even necessary for a paradigmatic shift. The use of these aesthetic experiences in a pedagogical context, and specifically in a scientific context provides what Greene (1978) refers to as “a ground for questioning that launches sense-making and the understanding of what it is to exist in a world” (p. 166). But what world do we present to foster understanding? What elements do we need to provide the context of existence? Do we revert to the periodic table? Carbon (C)? Hydrogen (H)? Oxygen (O)? Does the heavier molecular mass of Lead (Pb) give the curricular content more gravitas? Is Helium (He) too frivolous?

Inside Canvas Walls

If we do not expect the unexpected we will never find it.

Heraclitus (6th century BCE)

The circus ring defined by the traditional vibrant red paint is a semipermeable boundary. It is here that curriculum occurs. Earlier I suggested that the elements of circus include the script, the performance, the performers and the audience. Those interactions, those communications, those moments of acquaintance and caring, if you will, between performers and the audience are critical. Polish theatre director and theorist Jerzy Grotowski (1968) in his text *Towards a Poor Theatre* defines theatre as “what takes place between spectator and actor” (p.32). And this exchange is what makes good circus work. *Les Sept Doigts’ de la Main* (the seven fingers of the hand) is a Montreal based troupe whose concept is to create a show that combines the wonder of circus performance with the reality of people's everyday lives. Performed in small theatres, rather than a traditional circus venue, Gypsy Snider, with her small company, creates an intimate circus experience where the performers and the audience can interrelate. She describes the premise of her contemporary circus *Traces*: “One of the most important meanings in our lives, or the meaning of our life is held in the traces we leave behind. When you live your life considering that; how you effect people, how you share with people, how creative you are, how responsible you are toward the world, the planet and the people around you, it becomes the meaning of your life” (In Ellwood, 2010). The space she investigates is one created by the destruction of the present, and what is shaped in the space left behind. Gypsy creates a new myth, a story in which her characters find the

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meanings in the space of the circus, and so her voice echoes Bakhtin (1981b) as he suggests that all “local myths and legends that attempt, through history, to make sense out of space” (p. 189). Gypsy— an award-winning director and second-generation circus performer—in examining the space for myth making, understands the critical relationship between the audience and the performers on the stage. She draws on her past as a product of the circus.

And it is not so easy. In a nod to Grotowski, Pinar and Grumet (1976/ 2006) in *Towards a Poor Curriculum* remind us that

We cannot solely rely on imagination, however artful its expression, or reports of psychological problems or philosophic accounts of experience. Some synthesis of these methods needs to be formulated to give us a uniquely educational method of inquiry, one that will allow us to give truthful, public and usable form to our inner observations. (p. 5)

Gypsy does an elegant job of the synthesis Pinar and Grumet demand. She digs deep into her imagination to help fill the space with the personal stories of the performers. Her troupe presents the human condition, both the frailty and strength. They investigate the responsibility each of us has to the to each other as we face catastrophe while managing to distract you with feats of grace and power.

Gypsy has circus in her blood. Her parents founded the Pickle Family Circus¹⁶ which along with Big Apple in New York defined the era when New American Circus was born. Departing from the Barnum spectacle of three acts competing for the audience

¹⁶ This is the circus with which I performed for several years.

attention, the Pickle's returned to traditional European one-ringed setting; the ring was small and intimate—the children were seated just outside the ring's edge; with hands dangling inside the arena they were close enough to touch the performers. Audience members were at times encouraged to come into the ring and be part of the festivities. Founders Larry Pisoni and Peggy Snider were both concerned “with the role of performing arts in the community, how it served the community, and how one defines community” (Schechter, 2001, p. 46). Pisoni and Snider thought the circus should be presented “as a celebratory act: celebrating human experience and healthy relationships” (p.46). The Pickles ended every show with the Big Juggle, with performers and stagehands alike taking the stage in a show of cooperation and a celebration of the relationships embodied in the circus community. Of that act, Larry Pisoni says, “What we saying, if we were saying anything, is that cooperation works. And in that way incredible things can take place” (Pisoni in Albrecht, 1995, p. 27).

This celebratory act is a model of curriculum. By bringing these ideas to education, we make room for improvisation, non-verbal communication, and other celebrations of human experience. Recalling Grotowski's definition of theatre, along with the Sniders' and Pisoni's implementations, we show that it does not have to be one-way communication or the passive acceptance on the part of the student spectator, with the instructor assuming the role of lead actor (and only expert). Instead the performance counters the unidirectional banking method of instruction that Paulo Freire so eloquently described. We can view the circus as a dynamic place for ideas to be exchanged and a place where audience and performer meet and agree on the performance.

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By the interconnection and interdependence of performers and audience we insure that there is improvisation. The ring acts only as a suggested boundary. Performers breach the semi-permeable barrier with balloons and pratfalls, or rigging their apparatus beyond the border. Dancer, dance educator, and curriculum theorist Susan W. Stinson (1991) describes improvisation as “an apt metaphor for a process in which teachers and students engage together with mutual respect for each other” (p. 192). The structure of choreography provides boundaries, but within them “one expects surprises and discoveries” (p. 192). Audiences reach in with their wonder and delight, and touch performers with their smiles.

This same interconnection and interdependence insures that there is some type of story-telling, and by this act the circus is transformed from a noun to a verb. This interpretation parallels Pinar and Grumet’s reconceptualization of curriculum as noun to the verb *currere* (Mary A. Doll, 2000; Grumet, 1980/1999, 1988; W. F. Pinar, 1975/2000; W. F. Pinar & Grumet, 1976/2006). *Currere* “discloses new structures in the process of naming old ones” (W. F. Pinar, 2004, p. 58). The circus, too, provides new and sometimes surprising structures, often endowing ancient rituals with current context and novel meanings. Recurrent themes of human endeavors are cast and recast with characters echoing past present and future, earthbound clowns and gravity defying aerialist, allowing for a regressive, progressive, analytical and synthetical experience in one production. These four aspects of *currere* are most eloquently described by Pinar (2004) and can provide a richer understanding of ourselves, a richer understanding of the world, a world where the frames might be drawn in circus colors.

Performance

Remember this, - that there is a proper dignity and proportion to be observed in the performance of every act of life.

Marcus Aurelius

The term performance has multiple meanings, and while some educators might object to the idea of performing, I do not suggest the colloquial and more modern meaning “to do tricks in public.” Instead let us look at the heart of the word. Coming into usage as to “carry into effect, fulfill, discharge," via Anglo-Fr. *performir*, altered (by infl. of O.Fr. *forme* "form") from O.Fr. *parfornir* "to do, carry out, finish, accomplish," from *par-* "completely" + *fornir* "to provide." To completely provide...to provide people with the inspiration to do things, to be creative, to consider the shape of the world they want to live in, to consider how to do extraordinary things.

The circus showcases ordinary people doing extraordinary things. Circus performers practice between 3 and 8 hours a day, depending on how many shows they are performing that day. This is how they gain their strength and proficiency. While we love to see the performer sweat, what adds to our enjoyment is how easy it looks, allowing us all to imagine that we would go home after the show and do a back flip with ease.

Perhaps another way to examine curriculum is by employing the science of physics to shine a spotlight on performative aspect of education. While performers have internal monitors, the view of the audience is mostly external and it is through their eyes that we gauge the performance. So injecting self-awareness is part of the performance ideal.

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If I perform as student, I recognize the strictures that role invokes. I must sit in my seat, arrive “kinda” on time...do not let my cell phone announce its presence, and pretend to be, or... actually be ...interested. Perversely, as student, I understand even the slouch of sleep is an understood, if not accepted, performance.

If I perform as teacher, as inevitably we must, that role too has an internally recognized framework. But this frame has many shapes. We have examples that while seeming a farcical stereotype are too close to truth to be a fiction. There is the story of polymath Archimedes, a leading scientist of his day (~250 BC), having been long pondering the problems of displacement, who finally reached an understanding of the physics of buoyancy while settling into the bathtub. So enamored was he of his findings, he ran naked from the bathhouse through the town shouting “*Eureka!*” (Greek for “I found it”), as he rushed home to continue his calculations. The truth of the story is somewhat suspect, though it portrays quite a persistent theatrical moment, and a fine beginning to the stereotype of the absentminded genius.

A more current example, the archetype economics professor in the movie, *Ferris Bueller's Day Off*, who bored his students into narcolepsy, and yet delighted the audience of the film with such hilarity. Our laughter was inspired as we recognized the theatre of this professor as kernel if not the whole corn plant of truth in our experience.

This fictional example is but a shallow representation of the true nature of educational performance though. I do not intend to reduce the educator to mere actor. With apologies to the acting community, such a misunderstood characterization might suggest a diminishing of educators’ standing in their specific intellectual discipline.

Send in the Clowns



Figure 3: Pickle Clowns: Geoff Hoyle, Larry Pisoni, and Bill Irwin. Copyright Terry Lorant. Reproduced with Permission.

Alternatively, the clown/scientist/educator may take the lively shape in the form of Caltech professor Richard Feynman. He took his students on a magical mystery tour of physics, laughing, telling jokes, and beguiling them with science. He was a brilliant physicist, an excellent safecracker, and a good friend to many. And he was a performer of science. His supreme performance was in front of Congress, in front of politicians who were in charge of NASA budgets, and ultimately his salary. He performed, in front of the men and women who were supposed to be in charge of the critical analysis of NASA's mission and budget, with a plastic cup filled with ice water. With these scant items and a rubber O-ring (similar to a washer from your garden hose), the type used on the actual

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craft, he showed them the simple elegance of the physics that led to the darkly deadly and explosive failure of some of our Space Shuttle aeronautics. What was supposed to be a rubber stamp of approval meeting for NASA was fortunately turned into a performance by a trickster¹⁷. Performance, of this type, on the academic and political stage has broader implications, which include the concept of representation. The battlefield in curriculum is often about what is represented and who is authorized to represent it. Do we need more tricksters? More clowns?

...Or Wire-walkers

Teaching should be such that what is offered is perceived as a valuable gift and not as a hard duty.

Albert Einstein

Feynman's representation challenged many of the conventions of academia. Irreverent and impious, his representation is categorized as an outlier in what is perceived as a staid profession. He cracked safes and played practical jokes. What set him apart was his exceptional ability to negotiate the politics of the academy with the skill of a professional wire-walker. Dancing the slim wire between the hard fixed poles of administration and scientific rigor, he was playful with his presentation of self and work. A real wire-walker Philippe Petit (2008), famously traversed the space between New York's twin towers. He described the experience "as stepping into the unknown, as a

¹⁷ For the complete playbook see Feynman (1988)

profound and joyful voyage.” He considered his wire walking performance, a “gift.” A gift to the audience...a gift to the buildings...a gift to the city...a gift to himself? I do not know. He talks of his great love of the buildings. He talks of his great love for his art of walking in the sky. “Probably the most beautiful part of the event is that there was no why” (Petit in Reed, 2008). I do not know why it is important for me to teach, but I do know something of the gift of teaching, and that gift can be everything at once.

Petit, as he proscribed a ring of his own design, as he stepped onto the wire, he stepped into this gift. Petit improvised with the wind and the architecture. He partnered with the sky, the bounce of the wire, and the changing stability of balance. In so doing he became a symbol of freedom, a sign of beauty and the human desire for flight. Umberto Eco (1977), in describing Petit’s transformation claims,

As soon as he has been put on the platform [or tight wire] and shown to the audience...the man has lost his original nature of "real" body among real bodies. He is no more a world object among world objects—he has become a semiotic device; a sign...” (p. 110).

As a man on a wire, Petit became a teacher, showing us how to fly free from earthly constraints, how to defy the physics of a body grounded by gravity. In a classroom, removed from the rest of the bodies by standard conventions, the teacher is the semiotic device. The minute we place the teacher at the front of the room, she becomes a sign. As clearly as marquee lights announce the opening of a new play, she is a sign that a performance is about to begin. She has become a semiotic device; she has become a sign of what is to come.

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Clown Larry Pisoni suggests that circuses can be curative by presenting an affirmation of life...”by presenting the material in a way that can be applied to an individual’s life... [it is] a demonstration of something a human being can do. It is a gift from the performer to the audience” (Albrecht, 1995, p. 27).

Theatre director and theorist, Richard Schechner was not talking of wire-walking or teaching or clowning when he said, “performers specialize in putting themselves in disequilibrium and then displaying how they regain their balance psychophysically, narratively, and socially—only to lose their balance, and regain it, again and again” (Schechner, 1977/1988, p. xiv). But this is what good wire-walkers and good teachers and good clowns do...it is their gift...again and again.



Science and technology are reshaping the world in a new likeness. But is it a likeness we like. Have we taken the time to consider the shape of things to come? And how can we? With a 24 hour news cycle, Internet access, information is coming at us faster and faster. How is it possible to sort through it all with some level of cohesiveness? What skills will we need to improvise our way to the future? How do we sort through it to find the pieces that we need? Futurist Alvin Toffler (1991), examines the interconnectedness of economics, pop culture, business and politics (a cultural circus to be sure) and talks about the accelerating changes of today’s society, looking for the trends that foretell the future of our American and even global society. He reports:

The media fire blips of unrelated information at us. Experts bury us under mountains of narrowly specialized monographs. Popular forecasters present lists of unrelated trends, without any model to show us their interconnections or the

forces likely to reverse them. As a result, change itself comes to be seen as anarchic, even lunatic. (p. xvii)

What is the role of curriculum as we examine the landscape that is before us? We need to look very carefully at what is represented and who is doing the representing. In introductory science classrooms we focus the microscope on the inner workings of a cell. We provide a reductionist position of life so filled with mountains of narrowly focused facts, that we have no time to look up and see the rest of the world. “We are falling behind in math and science!” says Chicken Little, while no effort is made to examine what we even mean by that.

While students are counting carbon molecules cycling through the formation of sugars, we have lost count of the amount of carbon and mercury and other toxins that we are pouring into the skies of the world, making it more difficult for us to breathe. Heidegger (1929/1998) makes the point "Calculation refuses to let anything appear except what is countable. Everything is only whatever it counts"? Heidegger elucidates the sacrifice of our human essence by slavish compulsion “to master everything on the basis of the consequential correctness of its procedure” (p. 235). While students are required to follow the path of proton through a cell membrane, have we lost sight of the path of an ethical and sustainable future, the path of our human essence? While students will be versed in the breakdown of glycogen in the cell, are they neglecting the breakdown of empathy and understanding in our relationship with other species?

There are implications of this reshaping our worldview... we are allowing others to decide what we focus our microscope on. The media often will focus the microscope for us, giving us the juicy bits of gossip, the 15 seconds of distain or sympathy for people

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making missteps in life. Once the mind-numbing spectacle is out of the way, we can get down to business and order products that will make us more beautiful, thinner, taller, cellulite-free ...better people. 15 seconds of empathy is enough, right?

Masters of misdirection, politicians want us to focus on miscreant bankers, rather than the politicians themselves, who changed the laws to allow for the absurd “fox in the hen-house” model of business self-regulation. As they argue over the cost of universal health-care, education, and the housing crisis, our citizens are living in their cars, struggling to feed their families. We are focusing on a Second Life instead of our First one. We are focusing our text messages instead of the person in the room. We look at MySpace on our computer screens, instead of looking up into space. I fear for those who may not be able to widen their lenses to encompass larger ideas, that they may not be inspired to open the aperture of their focus to contemplate the stars.

“There is more than a verbal tie between the words common, community, and communication” (Dewey, 2004, p. 5). Because curriculum is a performance of communication, what exists has to be more than words. As educators we must fully provide opportunities to experience the world in different ways. While students are required to memorized the archaic dogma of DNA replication what should be conveyed about the social dramas that accompany the not-so-simple passing on of genes? What common actions are communicated in the non-verbal nervous laughter, the sweaty palms, and increased heart rate and blood pressure as these young women and men engage in a ritual of testing the limits of physiological and psychological pressure? What they learned about Mendelian genetics will only be revealed to me in the form of scantrons, as their

pulse returns to normal, and their bodies release the tension of the test. Not a word has been spoken, but what has been communicated?

Playwright Antonin Artaud (1958) suggests that sometimes language is the problem in shaping cultural conventions, saying:

It has not been definitively proved that the language of words is the best possible language. And it seems that on the stage, which is above all a space to fill and a place where something happens, the language of words may have to give way before a language of signs whose objective aspect is the one that has the most immediate impact upon us. (p. 107)

As we empty the space where “something happened”, dialogic exchange gives way to a language of signs, necessary for the execution of this oft-repeated social and educational drama. These and other social dramas are acted out in every classroom across the nation. But we do not give them credence; it is not part of the content of the syllabus. It is part of the “hidden curriculum.” With performance, there is a way to communicate ideas outside the boundaries of a given text, a given canon. It can be transformative in ways that transcends the written word. It is an embodiment of ideas and ways to examine the ethics of curriculum. Herbie Hancock’s music communicates and inspires. To provide completely...gesture, movement, a touch, a gaze, a nod, or the arch of an eyebrow, all embody communication in ways that words cannot.

Audience



Figure 4: The Crowd. Copyright 2008. Terry Lorant. Reproduced with Permission

The audience likes to be taken on new journeys.

David Copperfield

When the audience comes in, it changes the temperature of what you've written.

Stephen Sondheim

Curriculum theorist and educator, Morris (2006) points out, “Education is not entertainment, though many of our young students would like nothing more than to be entertained. Education is tough, it is hard work, it is the task of thinking through the sociopolitical as well as subjective experiences” (p. 14). It is in this process of “thinking

through” that performance engages the audience to join in the “thinking through.” It is hard work for all of us. Performance allows a separation from the text, a willful thinking through of subjective experience, leading towards a re-definition or re-membering of the curricular experience. British director Tim Supple notes:

Every time we approach Shakespeare, we must learn to see and hear again. The familiar must become unfamiliar and we need to face the words and story, free of the dead hand of habit and preconception. We need to trust what we actually find there and ignore what we are told or think we know or half-remember. (2008)

As we tell the same stories again and again, we need to approach them as if they are strange to us, just a circus act. “There aren’t any new jokes in clowning...you can trace most of it all the way back to the great [ancient Greek] playwright Menander, who used not only satire but also archetypes...its all the same” (Pisoni in Rubin, 2012a, pp. 21-22). If we break down the elements of a particular circus act, the extraordinary becomes a mirror of current culture: the mundane becomes the unexpected. Costumes, music, waiters, chairs, and plates of spaghetti, all the elements come from our cultural environment, yet are combined in an unusual way. Within the canvas walls of the circus, they are transformed, decoded by the audience, from the simple dining experience into a political act defining human acts of resolve, perseverance, and wage slaves¹⁸. But, unlike the audience attending most circus performances and theatrical events, the audience in many classes, particularly science is mostly reluctant and resistant to the journey. So

¹⁸ The act, *Spaghetti*, performed by Bill Irwin and Larry Pisoni, premiered in the Pickle Family Circus in 1975. For a complete description of the clowning see Schechter, 2001, p. 51.

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either with the subtlety of a magician or the brashness of a circus barker we must entice them into the tent and begin by helping them to forget their unwillingness. To ease them into decoding what they know, and making it a fresh experience. We must somehow persuade our audience to attend and hear the “story, free of the dead hand of habit and preconception” (Supple, 2008).

Both the classroom and the commons lend themselves to the circus analogy, since our audience assembles at a prescribed time and place, in anticipation of some event or spectacle. Because our audience represents a cross-section of class, gender, and tastes, there is always something of the unexpected in these encounters. Havel (1990) describes this as “the electrifying atmosphere of an intellectual and emotional understanding” (p. 40). It is this charged atmosphere that arouses us all from our sleep, towards Greene’s idea of “wide-awakeness.” What is presented may vary and so too does the perception of the piece by individuals in the audience.

The idea of perception is important to consider. Perception is a way of becoming aware of the world and helps us form our opinion of it. The French describe two stages of perception, “using *voir* for physical seeing (looking) and *savoir* for mental perception (understanding)” (Beam, 1958, p.38) and *savoir* is what distinguishes the individual interpretations of the thing looked at. Do others see what we see? I don’t know, but I think not. So then the question becomes...how do we help them to understand? How do we help them form their own new architectures? How do we help them develop their own unique performances? How do we help them develop their own identity as ringmaster? Or aerialist?

Understanding our experience of the world, is by nature “whole” learning. As children we come to recognize the world by tactile exploration, sensing with our hands, our mouths, our eyes and ears, passionately tasting, caressing and exploring the most mundane of objects. This empowering whole body process of learning starts long before a more mature cognition and reasoning begins. Our reality and our nature are shaped by our whole experience with the world, not just the literal or scientific description of it.

Reality exists in two worlds:

One the spiritual, subjective reality of human consciousness; the other the external world made up of the cosmos and our planet with its mountains, rivers, and trees, the lower animals and physical man; and all that man has made, including art.

Since our minds, blank at birth, are only gradually filled by experience, our contact with reality is the objective source of all art. (Beam, 1958, p. 6)

Beam’s insight into the duality and yet interconnected wholeness of reality lends itself to my own interpretation of why we need to keep science balanced with performance of the story. While we are certainly not a “blank slate” at birth, it is true that the objective and subjective are intertwined our understanding of the world. The truth of science is that the stories selected for re-telling have been isolated and stripped of any controversy from the rich full history of human endeavors. Any whiff of subjectivity has been whitewashed and dogmatically defined as purely objective. While historians may wish to include in the telling only our successes, the true history of science includes many “facts” requiring adjustment. (We may recall that until the late 16th century the “fact” was that the earth was the center of the universe). Jay Lemke (1990), a scientist and educator, admonishes, “Science’s mythical history is rather like an amateur genealogy

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that only includes the ancestors we are proud of” (p. 143). We need to break the rules of “objective”, formal dissemination of “facts” and re-institute “subjectivity” and look at science, and at learning as a human activity, “that science is a messy, human business, not a perfect method for discovering absolute truth” (p. 150). So in re-inventing science pedagogy, we must ignore what we think we know. We must re-turn and re-infuse and re-imagine the messy quality of humanness, and embrace all of our ancestors.

In talking science we must again recognize that using the lens of science is only one way to view the world. But surely as our inner observations reveal, there are other equally valid views of the world, through the eyes of art, politics, religion, mathematics, economics, music and circus. Educators are empowered to tell the story in the way that they envision it. We are also obligated to acknowledge and report that there are other ways of telling.

Sometimes in trying to understand our world, we find the words inadequate to describe how we feel, how we fit into it, how we fathom the duplicities and contradictions. “A scrupulous examination of the points of connection between reality and metaphor will reveal that it is through metaphors and the imagination that reality takes on meaning” (Bachelard, 1943/2002, p. 49). Bachelard helps us in our departure from the literal. With words alone inadequate to present and re-present the natural world, we must consider other ways in which to make matter matter. Contrary to common misconceptions about the literal and rigid nature of science, many scientists assert that in order to truly understand the nature of the world, one must have imagination. “I am enough of an artist to draw freely upon my imagination. Imagination is more important

than knowledge. Knowledge is limited. Imagination encircles the world” (Einstein in Vierek, 1929).

The language of art is the language of imagining and creativity. Specifically, the language of circus suggests play. How does play fit within the boundaries of science that requires factual observations and reporting? What do these childish activities bring anything to the discussions of weight and matter? I suggest that to transform the pedagogy of science we must rescue science from dispassionate observations to passionate and playful experimentation. We must invent new ways to tell old tales, and look to old ways to tell different tales expanding the cast of characters beyond the norm and the expected. By calling on art we can initiate a process “in which what is dark in us slowly becomes transparent” (Grotowski, 1968, p. 21). This is the same language that should be applied to science curriculum.

In *How the Mind Works*, Stephen Pinker (1997) describes the visual arts as a “technology designed to defeat the locks that safeguard our pleasure buttons and to press the buttons in various combinations” (p.526). If that doesn’t describe the circus experience I don’t know what does. I propose that by using some of the basic elements of circus, we can clarify and demystify science, and raise the temperature by pushing various combinations of the “pleasure buttons.” Maybe with a trip to the circus?

The Critics

In academe we have many different audiences, and whether we like it or not, the performance is being judged. We are first aware of our students, perhaps because they

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take up so much room in our mind and in the chronotope of the exchange. They are the hardest judges and the least experienced. Their pronouncements can deny an intellectual a position in the academy. Morris (p. 526; 2006) laments, “American educators must work continually to undo the madness of standardization” (p. 84). But students retaliate against the change. They are prepared for standardization. They have been well trained. They pool their ignorance with ideas of what connotes a good performance, and a good education, sometimes conflating the two. “Off-topic”, “too strict” ...”too hard”...but sometimes...”she helped me be better than good.”

We cannot blame them. They have been handed this power. They did not apply and need no qualifications for the job of critic. They have not yet been taught to think critically. What is truly surprising is that administrators sift through these student verdicts like oracles sifting through entrails looking for a sign of ...?

What makes a good teacher? What are they looking for? A quantifiable, irrefutable, incontrovertible, scientifically verifiable sign of...?

...competence? Of aptitude or ineptitude in meetings? Of being a team player? Oh, which team do they mean? Team student? Team Professor? Good grant-writing skills? Intellectual rigor? So as administrators add on their own critique of performance, we can be sure that they are looking up the food chain for their letters of approval. Entrails are notoriously hard to read. They can be so visceral and messy.

Critics also come in the form of politicians, with the unmistakable guise of clowns, who weigh in with the claim it is the educators fault that students are not performing up to their potential potentials. This group gets their reviews published in the *New York Times*. Though these men and women are twice or thrice or circus rings

removed from any classroom experience as teacher, or as student, they still feel competent and compelled to act as critic. Here they misdirect responsibility for all the ills of education to the most readily identifiable participants in the drama. Using the expletive “‘accountability,’ an apparently commonsensical idea that makes teachers, rather than students and their parents, responsible for students’ educational accomplishment” (W. F. Pinar, 2004, p. 5). Rather than looking to the results of failed policy decisions they insist that it is the incompetence of educators that force them to regulate teacher’s effectiveness and autonomy out of existence.

These same legislators argue that teaching is serious business...too serious to “play” around with. And indeed in 21st century education ...education is a business. The tradition is not new, but handed down and evolved from our understanding of nationalism and citizenship through education. This century we must “train our children to compete in a global economy.” There is no time for clowning around.

We still have to contend with the critics among our colleagues. Still we hear about classes with professors that “hold forth”...or refer to their own self-deprecating “dog and pony” show erstwhile only heard from in the circus. We can leave these comments and associations behind. These are not the performances of which I speak. These are shallow interpretations of the earnest communicative act of performing as educator.

So the remaining critic is the one of most value. The one that must be ever vigilant...and that is us. How do we self-assess? In an intentional act of what Pinar (2004) calls “revolutionary” we must commit to the method of *currere*. We must be self-reflexive in “both temporal and cognitive movements in the autobiographical study of educational experience” (p.35). We must engage our extended consciousness using both

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memory and reason to fully be aware of our steps on the tight wire. We must remember the kiss of the wind on our face and the solid stage of reason as a thin wire under our feet. We must remember to embrace our disequilibrium again and again.

Conclusion

The most beautiful experience we can have is the mysterious - the fundamental emotion which stands at the cradle of true art and true science.

Albert Einstein

“We never wholly understand our words, we never wholly understand the word understand; and we are never in a position to authoritatively interpret them” (Phillips, 2002, p. 100). Is what I say in my classroom “right” or “true” for everyone? While I don’t agree that we are as lost as Phillips claims, our interpretation of the words that describe our ourselves or our worlds are exactly that, interpretative. To fully appreciate reality, I think we need to experience more than one performance; we need to experience more than one text, more than one audience and we must listen to many, many critics. We need to experience the imagined or imaginary. We might even consider improvisation. “For reality is never singular, and may actually present two distinct faces quite apart from any interpretation” (Beam, 1958, p. 48).

The power of circus is we are allowed to perceive, using all our faculties of *voir* and *savoir*, mind and body, heart and soul, all of the senses at our disposal. “Art therefore, which transforms sense-objects into thought-thing, tears them first of all out of their context in order to de-realize and thus prepare them for their new and different

function” (Arendt, 1971, p. 48). What are these new and different functions? Should I be the one to define them for you?

Many dangers lie in believing too firmly in unwavering truths, in sticking too close to the script, turning commedia to something grave. Steadfast and enduring doctrine may be qualities necessary for overthrowing governments or certain classrooms. But theatre and poetry, as used in the case of Vaclav Havel, claimed a bloodless victory for far more people.

In a democratic society, science and science education must be answerable to the public. We need to explore new ways to communication difficult realities. So in deconstructing reality, we can approach it from different angles. We can see it with fresh eyes, as a multi-faceted thing not prone to the simplistic, dogmatic, hard, unfaltering, stripped stories of science. As scientists, educators and theorists we need to entice, entrance and expose an entrance to the big top. Perhaps we should decrown the king, the ritual act at the core of carnival that celebrates “*the pathos of shifts and changes, of death and renewal*” (Bakhtin, 1984, p. 124). Renewed we can reclaim the humanity, the magic, and the mystery into the field and remove the mystique that prevents engagement. The lessons presented by Havel leave us to choose the type of curriculum in which we wish to engage. We can invent a new polymer. We can choose to be enduring, unremitting, fixed and tireless, or we can choose to dance, to juggle, to do poetry, and play ... to engage and encounter the whole beauty and power of the natural world. We can run away with the circus.

CHAPTER 4

CIRCUS ACTS

The circus is a powerful cultural representation. It is a space where reality and fantasy are commixed. The woman is a clown but the clown is not a woman. Not really a buffoon but a skilled craftsperson whose hours of practice make the pratfalls seemed unrehearsed. It is a ring where women and men fly without wings. Where imaginations soar to the edge of the universe. The circus is a place of pluralistic and often conflicting environments, mirroring the culture as a whole. The circus is an arrangement of acts has a lot of multiple roles. Ring master, the sideshow barker, aerialists, and jugglers, magicians, fortunes tellers, animal trainers and their respective animals, freaks and geeks, and clowns and jesters. Add the midway, the menagerie and a sideshow, and we have our microcosm and metaphor.

Each circus ring is filled with different performers exhibiting some new act of curricular transformation. It is a multi-ringed environment which can lend itself to confusing, engrossing or entertaining situations. Here, curriculum theorists and other scholars walk the narrow wire across the spaces within and between the arts and sciences. They have filled the space with some novel understandings of the connectedness between them and in so doing reveal some fundamental problems in education. These acts are performed with some disquiet because of the circular nature of thought in a ring. As I see it, there are two main themes that evolve in this endeavor. First, we continue to educate as if the student is a *tabula rasa*, an empty vessel filled with nothing but anticipation, a recipient of ideas without any preconceived notions about how the engagements will

unfold. This imagining is false and leads us to live in Bakhtin's (1981b) idea of adventure-time where everything is controlled only by chance. Second, in spite of repeated attempts at dispelling this myth, there remain numerous obstacles in the path to change in education. It seems we are trapped inside a ring of entrenched ideas, of the deep prejudice of historical acculturation. Can we use curriculum to theorize our way to the future. This is an important and complicated quest, and thankfully my fellow players include Paulo Freire, Mikhail Mikhailovich Bakhtin, Donna Haraway, Bruno Latour, Sandra Harding, Katherine Hayles, Jacob Bronowski, and Mark Hansen and a whole cast of cameo performers in repeating and highly supportive roles.

It All Starts with an Empty Ring



Figure 5: Lorenzo Pisoni and friend. Copyright Terry Lorant. Reproduced with permission.

It seems a miracle that young children easily learn the language of any environment into which they were born.

Niels Jerne

A different language is a different vision of life.

Federico Fellini

The ring always starts out empty before we people it with acts aimed to transform. But an empty ring is not an empty space. Even with no performers present, it is filled with the anticipation of the stagehands, the performers, and the audience, all wondering

how the engagement will unfold. It is filled with memories and historical whispers. It is filled with the seed of an idea to transform the world for a moment. It contains all the time space engagements of circus culture. “We will give the name chronotope (literally, "time space") to the intrinsic connectedness of temporal and spatial relationships that are artistically expressed...”(Bakhtin, 1981b, p. 84). Bakhtin, a literary and cultural theorist, uses chronotope insofar as it is concerned with literature, but here, I will borrow from him the idea of the chronotope not with respect to literary theory, but as it works within the circus of curricular thought. Bakhtin extended Einstein’s Theory of Relativity to literary criticism, using the flexible nature of linked temporal and spatial dimensions to express a wide variety of cultural ideas, concluding that the chronotope is a “’bridge, not a wall’ between the mind and the world” (Clark & Holquist, 1984, p. 279)

To live in chronotope is to attend to the context of culture. This attendance is counter to the idea that we are starting in an empty ring. “During the past century the doctrine of the blank slate [or empty ring] has set the agenda for much of the social sciences and humanities, Psychology has sought to explain all thought, feeling, and behavior with a few simple mechanisms of learning” (Pinker, 2002, p.6). Beginning with the 17th century Lockean idea of the tabula rasa, or that at birth human beings have no innate knowledge. That idea has persisted in spite of common sense counter observations by parents and teachers as well observations by social scientists and neuroscientists. We continue to teach as if the students (now no longer infants) do not have their own interests and ideas. In our actual mode of teaching, their interaction is denied, their context is denied, and their speech is discounted.

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“If speech genres did not exist and we had not mastered them, if we had to originate them during the speech process and construct each utterance at will for the first time, speech communication would be impossible” (Bakhtin, Holquist, & Emerson, 1986, p. 79). Yet we do imagine that without specific and specialized language our students are incapable of communication, incapable of doing science and art.

Who has not been astonished by the simple yet astute observations of children? We are delighted in their simple artwork and celebrate their naïve “scientific” explanations of how the world works. Children are “doing” science and art without the benefit of specialized language. They do these things without any ontology, but simply as part of the “being-in-the-world” as Heidegger might describe these seemingly innate social practices. But these early ways of being with science are scarcely recognized. Science educators often begin with specialized vocabulary lists, (“They don’t have the language yet”) to introduce scientific lexicon, scarcely recognizing that the definitions are often self referential and lacking any context.

But the concepts already exist within our culture. “Science, we are growing aware, is a method and a force of its own, which has its own meaning and style and its own sense of excitement” (Bronowski, nd, p. 4). And indeed we are excited by the reports of hybrid cars, or faster cars, of bionic arms, and “miracle” cures. We are experiencing science as we accept wireless communication, television, medicine, and cleaning products into our homes. We are nurturing the next batch of discoveries as our excitement shapes the direction of medical research and gaming technology. We are speaking the language of science while we are talking about medicine, electricity, gaming, and computer technology.

Mathematician, poet, and polymath Jacob Bronowski suggests that science *is* a language, in and of itself, “for a language is no more than a code for describing some chosen features of the world” (nd, p. 80). Perhaps laypersons are not talking in the specialized code that scientists speak between themselves, but they are still embedded in scientific thinking. Bronowski (1939/1979) also makes it clear that he views poetry as a valid way of describing some features of the world as well. “The mind of man has a knowledge of truth beyond the near-truths of science and society. I believe that poetry tells this truth” (p. 11). So here Bronowski has found the uniting feature of poetry and science in their basis as symbolic languages and ambiguity of truths. And interestingly, while he does not address the specifics of the symbolic language of theatre, this is the form for which he is most famous. With television as the electron *tabula rasa*, Bronowski set the stage and performed as dramaturge, teacher, mentor and friend as he wove culture and science together with theatre in his BBC production *The Ascent of Man*.

During his program millions of television viewers were able to do science, to think scientifically without the specialized vocabulary my colleagues assume we must have. Instead by using the symbolic language, the language already present in our culture, we audience members were engaged in a conversation about presumably complicated scientific events, without even the basic knowledge of Kepler’s laws or Mendeleev’s periodic table. And so I turn back to the epigraphs with which I started this section; Nobel laureate Niels Jerne (1984) reminds us of what is glaringly obvious, but overlooked so often in education, “young children easily learn the language of any environment into which they were born” (p. 223). Children, who grow up on boats, learn the way of waters by knowing the feel, sound and colors that may not reveal themselves

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to us clumsy sailors. Children who grow up in the circus learn to juggle, do acrobatics, and some of them learn to clown around. Lorenzo Pisoni, born into the circus debuted his first and faux clown act at age two, in his diapers, walking into an empty ring during intermission, doing simply “what he saw going on all around him” (Snider in Rubin, 2012b, p. 28).

Lorenzo’s life mirrored the apprenticeships of old. Prior to the 18th century, there were very few schools. Children invariably learned by imitating their parents and acquiring the same skills as builder, shoemakers or working in the fields. Nowadays both parents spend time in an office and the children see on TV a very few trained professionals (doctors, lawyers, police officers), compared to the thousands available. The schools, instead of showing children models of professional or otherwise successful life, break understanding into smaller unrecognizable bits of factoids, leading all of them to wonder, “when are we ever going to need algebra”? I am not suggesting we return to archaic methods, merely that we recognize what we are valuing as important information. We are failing to provide basic tools to understand how to live and play in a multidimensional society.

Humans are necessarily adaptable, as evidenced by our continued and thriving presence on the planet, so perhaps it is time to fill space of tabula rasa with ideas and use an element of play. “Inside their work they are at play...imagining and creating new situations, and that is the greatest fun in the world” (Bronowski, 1978, p. 23). As Bronowski describes scientists and artists at work, he recognizes that they are united in something very fundamental to human thriving and creativity and pleasure. He

recognizes that pleasure can create the space needed to dream and to imagine new ideas, to learn, maybe even to clown around.

The Trunk: Tools of the Trade



Figure 6: Lorenzo Pickle with Trunk and Gorilla. Copyright 2008. Terry Lorant. Reproduced with Permission.

If the only tool you have is a hammer, you tend to see every problem as a nail.

Abraham Maslow

You need a trunk.

Lorenzo Pickle to Willie the Clown

The steamer trunk is one of a clown's tools of the trade. Everything a clown could need would be in there. Bill Irwin, aka Willie the Clown, would "show up to the circus gig with all this stuff in my arms and draped over my shoulder...the problem was that when I got a trunk, I used the trunk in the act...so I needed another trunk for storage, and so on" (Schechter, 2001, pp. 67-68). Trunks are always full of props, balloons, tubas, or other clowns. They are also always filled with great ideas.

Not only do we treat students as if they did not have a trunkful of interests or ideas, but some teachers only see the brass nail heads sticking up. Freire moved away the idea of *tabula rasa* and created learning space by shifting the educational system away from the top laded banking method to creating space for exchange between student and teacher. Freire's ideas revolutionized educational thinking internationally. One of his key ideas was to examine the "banking" method of teaching and learning and see it as a non-useful space. Instead, his idea was to use the space left behind when the bankers were thrown from the room. He thought a better use of this space was dialogue and the idea of working with each other as opposed to one in service to the other. What he and most educators in the trenches recognize is that learners come to subjects with many pre-conceptions, some true, some false. This is not exclusive to the sciences. Lessons learned then are a comingled version of the presentation. If we recognize this, then we can create a space where the learner and the teacher change roles, allowing both to be better for the interaction.

Paulo Freire (Freire, 1985) in reinterpreting the nature of the teacher-learner relationship, said, "We can learn a great deal from the very students we teach. For this to happen it is necessary that we transcend the monotonous, arrogant and elitist traditionalism where the teacher knows all and the student does not know anything" (p.177). This statement explains his rejection of "banking education" and in so doing opens a space between teacher and learner in which dialogue can happen. This dialogical space between teacher and learner is the very place where learning can occur. In the circus, it is the place we hope to achieve.

This space is so often lacking in science education. I was taught using the banking method. For me, it worked, but it was my sweet spot. I had fun climbing into my trunk of ideas, imaging and creating new situations. I loved figuring out how things worked, designing an act fit only for microbes. I was capable of creating my own context. For some of us who revel in the collection of facts, "call and response" education works just fine. A good performer, I knew my lines. But I also knew those nuggets of information were precious jewels to be collected and filed away until the occasion presented itself. I knew the first use would be as I regurgitated them on the test. But, I was able to see my basic classes as future tools, though their use was not entirely clear. So in collecting the pieces of information, the scientific facts and biological tenets, I recognized that I might not use these things until a later date. Just as when the wheel on my bicycle is wobbling, I am glad I bought the 32-piece wrench set, though at time of purchase I wasn't precisely sure what I was going to do with them. I was able to store my tools until I needed them. But still, I was also surprised when in graduate school they took off the training wheels. I was supposed to think for myself, use all the tools, invent new ones and apply them to

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ideas that I was supposed to formulate. Suddenly, I was supposed to be the “expert”, riding the two-wheeler round the ring, as more and more students piled on in an act superseding the best of Chinese circus bicycle acts. In my first semester of graduate school, the university assigned me my first official role as expert.

What I discovered very quickly was that I had assembled a metric toolbox with ancient tools. While I was perfectly willing to share them, most of the students were working on idiomatic bicycle wheels, so the tools didn’t fit. I began with the same tools with which I had been taught: memorization and regurgitation. The students were more interested in popular culture than the culture of science, but more importantly they wanted to get out of school and get a job inside that culture and outside of the irrelevant culture of school. My bicycle act crashed under the weight of inexperience.

Science practice and the practice of science education have companionably reified the myth of the scientist or science educator as the keeper of Truths, and knowledge of how the world works. Removed from the context of any space or place, science is not subjected to contextual examination. We have forgotten to look at the tool to bicycle correlation. This mythos has allowed science to remain removed from the realm of the real everyday lives of individuals. But the truth is, sometimes we just need to tighten up a lug nut, or oil the hinges of the trunk. Hey Paulo, can I borrow some of your tools?

Juggling with Descartes

“The right half of the brain controls the left half of the body. This means that only left handed people are in their right mind.”

Abraham Maslov

Sometimes a man finds love like a prison. Maybe it makes him a little blind looking for something.

Robbin Ford

Despite my conviction that we must reunite the heart with the mind, I must confess that I have fallen in love with the dualist Descartes. The first epigraph above is a joke of course and an oversimplification, and that is how many of us like our science. There are elements of truth in this statement, as is true with all good jokes. There is also an element of scientific truth; the functions are lateralized (controlled by one side), but this is only a tendency, most cognitive functions have components in both halves of the brain. (Though I am sometimes convinced that some of my colleagues are working with less than half a brain.) Jokes aside, the separatist discrimination of right-brain...left-brain is firmly rooted in Western philosophical dualism.

Beginning with Plato and aided by Descartes, Western thought has been shaped to keep us separate from our environment and ultimately ourselves; to set ourselves in opposition to ...well ourselves. Mind in one sphere, body in another. That we are disconnected from the world is no doubt one of the most enduring legacies left behind by Descartes. Already discussed in Chapter One, “I think, therefore I exist” proclaims the

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unity of thought (mind) or what he considered to be the soul and body. The aporia opened by this Cartesian circle is a wonderful site, a third space, in which to wander/wonder.

Curriculum theory brought me back into the life of Descartes. Previously indifferent to his charms before, I now am dazzled by the magnitude of his thoughts. His legacy is one for which we should all be grateful. First of all, his invention of analytical geometry and the coordinate system...the subject that plagued us in middle school (remember trying to sort out the x and y coordinates on a graph... at some point they added z!) ... this system ... is what even allows a discussion of space. His ideas gave rise to Einstein's extension of the concept to that of space-time continuum, which launched us past our mere imaginings into the dark matter reality of space. Aided by a host of other visionary scientists, we are positioned to imagine our place in the universe. And with further help from jugglers and poets we might see ourselves in a universe yet to be discovered. But geometry is not our only tool for visualization. We need to employ our imaginations. We need to employ circus, and watch the ring act as she proscribes three dimensions in the air. As Maxine Greene (2001) states, we "can only be enriched when we actually work with the raw materials of music, dance, and drama; the medium of sound; the medium that is the body in motion; the medium of language or gesture or movement in space" (p. 10). With body in motion, these elements of flight enable us to "feel more, to sense more, to be more consciously in the world" (p.14). How else can we imagine the x and y and z of three dimensions on a two-dimensional sheet of paper? How else would he have created his coordinate system, where previously none existed? How else would Descartes envision himself more consciously in the world? Picture him on the trapeze.

So as he was struggling with his external coordinates, he was also considering his internal coordinates, his internal theatre. So in addition to his mathematical genius, I want to consider his philosophical, perhaps even poetical musings, on the dualist nature of mind and body.

Turning to another brilliant explorer, Novelist Alan Lightman in trying to capture the soul of Einstein's creative nature wrote, "Some evenings he [would] return to his desk knowing he has learned things about Nature that no one has ever known, ventured into the forest and found light, gotten hold of precious secrets. On those evenings, his heart will pound as if he were in love" (Lightman, 1993, p. 105). I don't know what Einstein dreamed, but surely he captured the essence of men and women who dream big. I think he may be describing the dreams of all explorers and seekers. Descartes was prone to pondering the night sky watching the stars and the planets move overhead. He is said to have dreamed, "bizarre, richly image-laden sequences manifestly full of anxiety and dread. He interpreted these dreams...as revealing to him that mathematics is the key to understanding the universe" (Bordo, 1987, p. 1). And while his ideas of the universe aligned with the heliocentric Copernican model and helped him devise a mathematical system of place, his dreams were of passion ... *Passions de l'âme* (*Passions of the soul*, 1646). He was in love with ideas. The first article in *Passions de l'âme* states, "That what is passion in regard of the subject, is always action in some other respect" (Descartes, 2008). Descartes described the passions, caressing them into a list and then encouraging the expansion of each one of them with thoughtful consideration. What his own passions required him to do was to take action—to think and to write. To consider, think, and

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write. And consider and reconsider again after discussing, agreeing, and disagreeing with other thinkers of his time.

Descartes embodied and reified our idea of binary thinking. Us or Them. Friend or Foe. Black or White. Are we less than whole when we exist only at the poles of thought? William Pinar (2004) suggests that we are “colluding in the cultural reproduction of dualisms, among them ... are the public/private divide, male/female, black/white, gay/straight” (p. 149). But, with each set of opposites, we still have unity, transcending and containing the binary. I suggest that we are preconditioned to this binary and polarized thought. Bakhtin again, “Everything in his world lives on the very border of its opposite. Love lives on the very border of hate, knows and understands it, and hate lives on the border of love and also understands it” (Bakhtin, 1984, p. 176). One idea... two oscillating sides, facing each other. We only begin to understand when we are at this border. This is not to suggest that we have no choices. We are cognizant and capable of consideration. We are human, though I think not as “tragically” as Pinar (2004) suggests, but gloriously. This humanness allows us to enter the middle ground, the space between the two faces of a coin. If we consider the two faces, we still have unity in the coin. It is an unusual place, since the face of the coin is stamped and hard and temporal and geographic, tactile, dimensional and sensual... the tail retains those same features, yet it is the opposite. What is the essence of the middle?

The middle, I believe, is a dialogue, the difficult dialectic conversation of curriculum. Bakhtin believes that “Dialogue moves into the deepest molecular and, ultimately, subatomic levels” (1981b, p. 300). Peering at the subatomic, and watch the electrons jump between orbital rings, we can move deeper into the coin, changing the

focus on our lens of observance, perhaps becoming more attuned, getting closer to the vanishing point. If we consider the idea that dialogue is not merely an assemblage of words, but ontology, we arrive in that middle space. Donna Trueit's (In W. F. Pinar, 2004, p. 159) assessment that the term 'dialogue' has a negative connotation, which she suggests because of the notion of an agenda. I disagree. In any interchange or exchange, there is always an agenda. We all have something on the line; we all have a point of view. There "can be no such thing as a neutral utterance" (Bakhtin et al., 1986, p. 84). Sometimes it is just hidden below the surface. Sometimes it is even hidden from ourselves, as we believe ourselves objective and open-minded participants. Here we are living in what Bakhtin would call adventure-time—a decontextualized space—an ahistorical moment—where "an individual can be nothing other than completely passive, completely unchanging" (Bakhtin, 1981b, p. 105). But we have to move beyond the surface. We should not move through the world leaving "no traces—neither in the world or in human beings" (p. 106)—as if nothing happens between two moments. I suggest that we must move deeper into that space; we must plumb the depths of the coin; find our way within the chemistry. Within the millimeters of space between the front of the coin and the back of the coin, between the head and the tail, is the alloy, the amalgamate polymers of metal add strength to that which holds the polarity of the individual positions together.

If I toss the coin in the air and students are asked to describe the forces acting on the coin when it is at its midway point, something very interesting happens. Over 90 percent of high school students and 70 percent of college students will answer that there are two forces at work: the force that pushes the coin up and the force of gravity. It is an

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interpretation of physics that is pre-Newtonian and it is wrong (only gravity is at work). This example shows clearly that the blank slate that teachers expect has already been obscured by preconceptions. And how strong those preconceptions are. The students believe that if there is movement, there is always force acting in the direction of movement. And in spite of the teaching we provide, many still maintain that initial pre-Newtonian idea, though now they can flip the coin out of view and provide a momentary correct answer for a test, returning to their original concept once the coin lands back in their hand.

There is some evidence that Descartes may have been moving toward reconciliation of his dualist ideas at the end of his life, perhaps glimpsing the bridge that Bakhtin would build centuries later. But however he resigned his duality, it would serve us well to move forward from the era of separatist and constricted thinking and return to the whole. Descartes cannot be wholly blamed for his inability to reconcile reason and emotions, for he did not have the powerful tools of neurobiology at his disposal. It has only been in the 1990's that scientists have determined the interconnectedness of rational thinking and emotions. According to neuroscientist Antonio Damasio (2005), "the reasoning system evolved as an extension of the automatic emotional system, with emotion playing diverse roles in the reasoning process" (xi-xii). Further science has shown us that the "brain and body form an indissociable organism" (p. 88). The mind not only directs actions of the body, but the body sends signals to the mind, and the brain sends signals to itself from parts that have received signals from the body! Convincingly indissociable. Intimately intertwined. Can we recognize the parallels of our human form

to the form of culture? “In our enthusiasm for specification we have ignored questions of the interconnection and interdependence of various areas of culture” (Bakhtin et al., 1986, p. 2), Vindicated by science—what was once a philosophical journey—we must reconnect the isolated parts and allow the parts to become stronger and more powerful as polymer.

Other scholars, including mathematician Alan Turing (In Hodges, 2002) and educator bell hooks have recognized both the obvious elegance as well as the necessity of an integrated whole; bell hooks (1994) states:

...those of us who have been intimately engaged as students or teachers with feminist thinking have always recognized the legitimacy of a pedagogy that dares to subvert the mind/body split and allow us to be whole in the classroom, and as a consequence wholehearted. (p. 193)

John Cottingham (1997), a Cartesian scholar, has studied Descartes’ ideas for decades and suggests that his philosophy regarding the division of reality “into two fundamentally distinct kinds of entity-thinking stuff and extended stuff...[has become] less a paradigm than a prison” (p. 6). And I suppose that it is true—for Descartes’ passion did imprison him, compelling him to use his body in service of his mind. And, as the second epigraph by songwriter Robin Ford suggests, it may have blinded him in the looking. Some scholars, some scientists, and some science educators, blinded by love or passions, do join Descartes in his Cartesian cell and forget the outside world. But his ideas also present the antithesis, another side of the coin, the freedom to use his ideas as a point of departure. His foundation has given generations of theorists, philosophers, and

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other thinkers, the ring, and even a clown's trunk in which to work passionately, play unabashedly, to dream, and feel love immeasurably.¹⁹

I don't know if Descartes would appreciate being brought into the circus as a juggler, but I think he might. I am writing to imagine the architecture of such an act. An expert at juggling mathematical reasoning he traded clubs for fire sticks as he applied his ideas to the existence of god. No clubs could fall during the act, but the possibility of this keeps his friends and enemies in a ready state of tension. Even when he is caught in a ring of circular reasoning, his clubs miraculously remain in the air. While his concluding "ta-da" allegedly left his physical body separated from its head²⁰, his ideas are still up for grabs. Even semiotician of the circus Paul Bouissac (2010) has picked up one of Descartes' juggling balls claiming, "that even the simplest circus act must be ultimately described as a brain performing for other brains" (p. 23). We are still considering juggling leaf cascades²¹ as Descartes makes continued curtain calls.

¹⁹ The more damaging idea may have been when he proposed that the world was mechanistic—a machine that worked according to laws dictated by a distant and monarchical God.

²⁰ There are rumors that his jawless skull now resides in the Musée de l'Homme, in Paris, France, while his body lies in the Abbey of Saint-Germain-des-Prés.

²¹ With one leaf in each hand, toss leaf 1 across body, then leaf 2 other direction across body. Catch leaves in opposite hands. The cadence is toss, toss, catch, catch.

Trick Riding

As I live and am a man, this is an unexaggerated tale - my dreams become the substances of my life.

Samuel Coleridge (1907)

In trick riding, with your horse galloping at full speed, you must jump off the saddle and swing your feet to touch the ground and swing immediately back up. Samuel Coleridge, being blessed or cursed with a poet's imagination, asked his readers for "that willing suspension of disbelief for the moment that constitutes poetic faith" (Coleridge, 1907). We did so and went with him on adventures with *Kubla Khan* and the *Rime of the Ancient Mariner*. We continue to do so as we travel to the Wild West, or attend the circus, knowing that it is unlikely the bareback rider will be trampled, but in good poetic faith, we hold our breath nonetheless.

The idea of the nature of knowledge or ways of knowing is both ambiguous and hotly contested. William James (1975) suggests the concept of *approximations* saying, "...as the sciences have developed further, the notion has gained ground that most, perhaps, of our laws are only *approximations*...investigators have become accustomed to the notion that no theory is absolute a transcript of reality, but that any one of them may from some point of view be useful" (p. 33, emphasis added). We can only approximate how spectators will judge the levels of skills our trick riders will have, but we can suppose that there are as many *specific* points of view as there are persons in our audience. The course the riders take bring them through a topology attended by judges of

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positivism, phenomenism, empiricism and rationalism. But it is a staging space where various thinkers and philosophers are taking a stand and some are taking a standpoint.

Sandra Harding (2004, 2008), a self-identified feminist philosopher of science, uses just such a standpoint to examine the culture and practices of science that led to exclusion of women. She artfully choreographs three horses, manes braided with interdisciplinary criticisms of science: feminist empiricism, feminist standpoint, and feminist postmodernism to open a space for dialogue and controversy. Harding (2004) recommends a feminist standpoint epistemology that generates “systematic methods for locating knowledge in history” (p. 128). Using postcolonial theory, she is accommodating history while moving the focus to what she considers is the privileged position of underrepresented populations, using gender as her model system. With her scholarship she exposes how power relations are embedded in science rhetoric, and ultimately affect the social dimensions of knowing.

Standpoint theory uses “such differences as those of gender, race, and class, to provide resources for achieving stronger forms of the objectivity, reliability, and rationality of scientific work than conventional sciences and philosophies of science have produced” (2004, p. 114). And as such, it supports her call for “stronger objectivity” claiming that exclusion of social context is not objective at all. She pushes for inclusion of the lived experience of those not ordinarily included in knowledge production (Again, for Harding, gender is most often used as the exemplar of those excluded from the center ring).

While I was embedded/embodyed in the culture of science, I might have disputed Harding’s ideas. I was as certain of the objective nature of science and my own

objectivity just as I was sure I was a feminist. Riding the horse of my own choosing, I had been wearing comforting blinders that suddenly became transparent. Years of seemingly innocuous observations were all suddenly fomenting into a different vision. Nietzsche (1918/1956) says, “[t]he more emotion we allow to speak in a given matter, the more different eyes we can put on in order to view a given spectacle, the more complete will be our conception of it, the greater our ‘objectivity’” (p. 255). I was seeing with different eyes as I stepped outside the small stage of the center ring of a laboratory, where I performed ably as scientist. But in acting as scientist I was forced to jump through the rings of fire. As with all disciplines, I was forced to choose sides. I was forced and forged into a narrower view of the world. My vision was reduced to include the smallest interaction between one specific part of one specific cellular protein and small segment of DNA where the space was measured in Angstroms. My imagination had no room to move. I was to be objective and dispassionate. I felt I needed to return to the whole hearted, whole bodied, whole minded passions that seduced me into bioscience in the first place. I became aware of the attendant dialogue associated with doing the work of science. I began to shift my thinking ever so slightly, perhaps like Gaston Bachelard (1958/1969) when discussing his shift away from his objective observer of the material world. He said,

Little by little, this method [of avoiding personal interpretations] which has in its favor scientific prudence, seemed to me to be an insufficient basis on which to found a metaphysics of the imagination...To say that one has left certain intellectual habits behind is easy enough, but *how is it to be achieved?* (p. xiv, emphasis added)

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As I walked baffled and newly blinded by the stage lights, smelling of sawdust, I saw revealed, the new cues for my work. As with any ideological shift comes the responsibility to engage in critical thinking about that work. How is it to be achieved? Where did I fit in the continuity, the re-playing of science in science education? I have begun to look at how we currently make knowledge, and also to consider how to improve the ways in which science knowledge is constructed, and how it is applied. I am a player on this stage, what part do I play? This intellectual engagement is laden with responsibility and is no small task. It was time to look at all the horses in the ring. But, *how is it to be achieved?*

I am grateful that Harding too has a large toolbox, the equivalent of a clown's steamer trunk, and she too is willing to share. In order to achieve a new vision of myself and of science, I had to reenter from a different side of the stage. Harding, concerned with identifying modes of repressive power, has examined the stage and begins to dismantle the current theatre by using a critical analysis of how women are perceived in science. She is examining the historical nature and damages caused by the current androcentric approach to assessing meanings in science and technology practices and research, particularly with respect to biological and social sciences. With this analytic tool, she is opening up space for the discussion of gender exclusion in the production of science, and in so doing she exposes one narrow path through different arenas of epistemology. Not content with a narrow path, Harding uses a scythe to widen the discussion by also assuming the challenging role of linking social justice issues to science and technology practices. Politics, of course, have always been linked to science and technology. The US government's launch of a math and science initiative in public

schools coincided with the launch of the Russian's Sputnik. The scientists and businesspersons associated with stem cell research are lobbying the government for more taxpayer dollars to forward their agenda. More insidious, is the government's involvement in pushing "moral" legislation. By muddling the issues attendant to ideas about the beginning of life with the allocation of scarce research dollars, the players guarantee certain immobility, while revealing the ringmaster's hand of government in the "objective" world of science.

I entered the world of science because I believed it was calm and "objective." I loved that it worked to make sense of the world, to bring order to chaos. I say the same of the circus, circumscribed by our traveling family of players, we took the chaos and made it plain, tearing down the walls each night and reconstructing them in each new town. We each knew our tasks, and aided one another in the completion. It was the same feeling of comradesly and order in the lab.

Different from the lived-in world, within science the natural world could be broken down, explained, and the complexity of cellular structure could be reduced to a series of interconnected but distinct processes (break down, pack, unload, set up). Simple really. Ah, but science turned out to be not so simple; in order to create these simple models you have to create artificial "closed systems." Reduction of complexity is necessary for experimental research, so as you design experiments to "discover" the innate property of a cell, you begin to eliminate as many variables as you can. This should not be mistaken for reductionism, but perhaps instead recall James notion of "approximations" as the complexity of the system or organism studied remains intact. So one might eliminate other cells, or certain nutrients from the experimental design, or even

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the cell itself, leaving behind the proteins or DNA in order to reveal the intermolecular interactions. Where problems occur most often is when the closed system is the researcher's mind.

Is this the place for Coleridge's poetic faith?

Riding Under the Horse

In trick riding, while the horse is in full gallop, you must master the art of falling from the saddle and sliding under its belly for a ride around the ring. There is a carnivalesque logic that applies to the misalliance of the world...a world inside out or "upside down": an emperor in the nether world becomes a slave, a slave an emperor, and so forth" (Bakhtin, 1984, p. 133). This same carnivalesque logic applies to the imagined immortality of those buying space on a hard drive to store their DNA.

July 30, 2008 - Richard Garriott, designer of Tabula Rasa [an MMO game], has announced that he will travel to space and bring various gamers' DNA in a digital time capsule with him. The DNA will be stored on what he calls the Immortality Drive and Garriott will take it with him to the International Space Station. (Thang, 2008).

On *Star Trek*, using fictional transporter technology, whole persons were dematerialized and formatted into digital patterns and rematerialized cognitively and bodily intact in a different location. While scientists and technologists are busy in laboratories actually trying to make fact from this fiction, Garriott, in this case, will select a few lucky winners, sending them a DNA sequencing kit, which is really just spit or blood or urine collection (details were unavailable). These bodily fluids will be

transferred to a lab that will deconstruct them, using complex chemicals and technologies. The DNA is extracted, chopped, amplified, and then put back together as a digital read of the letters ATGC, and stored on a small printed circuit board grandly called the Immortality Drive. The sequence is unlikely to be complete, but more likely to be along the lines of an internal fingerprint, just an avatar really, perhaps not too dissimilar from the avatars created for his games. But the selling point of this process is that the avatar will be transported via complex technology to a space station to be immortalized, floating around in outer space for as long as that technology lasts, which is, presumably forever, or until it falls out of orbit. Digitized immortality? Even as a chip avatar we are not a tabula rasa. At least until the space station is destroyed or declared irrelevant. Why are we not focusing on things that matter, rather than an immaterial representation? Should we look to immortality not as the fragments of a person's life that mattered, but digitized fragments of AGCTs in floating in outer space? Are we still immortal if no one visits our avatar? What do we learn about ourselves when we send a representative of our DNA into space? Is it science or is it art? Is it both or could it be neither?

This particular digital representation is moving toward a decidedly posthuman condition; according to Katherine Hayles (1999) who suggests the “posthuman view privileges informational pattern over material instantiation, so that embodiment in a biological substrate is seen as an accident of history rather than an inevitability of life” (p. 2). In leaving out the rest of her suggested descriptors of the condition, I am being deliberately provocative, by suggesting that the disembodied representation of a human is a privileged representation. Hayles (2005) actually argues very strongly for “versions of

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the posthuman that would acknowledge the importance of embodiment and be conducive to enhancing human and nonhuman life on the planet” (p. 2). And really, it is nonsensical to argue for a posthuman condition without us...humans. The point I am getting to is that we have long considered various representations as valid avatars for real persons. We use photographs, digitized computer images, motion pictures. We also use stories both real and fantastical. We use verbal stories and those printed black text on white paper to portray human beings or their specific traits.

The notion of avatars has multiple meanings. According to Encyclopedia Britannica Online, an avatar is a Sanskrit word meaning descent, often indicating the human incarnation of a Hindu deity. More generally it has come to mean an embodiment or manifestation of an idea or philosophy. And of course more recently it has taken on the de-fleshing of the body into a digitized representation of a computer user’s alternative self with in cyberspace or a virtual world like *Second Life*®. Cyberspace allows for the exceptionally rich aspect of “a second world and a second life outside officialdom”(Bakhtin, 1968, p. 6), a carnival, that we can use to bring “multivoicedness” to the center ring. Avatars need not be humanoid, though most them appear to be. Clownish in appearance, as with any deity, how much devotion they invite depends on the incarnation, and our notion of devotion. With some avatars the descent from deity to human parallels our descent from flesh, tissue and bone to fingerprint of digitized media. This requires transporting our “material instantiation” to an “information pattern.” In a distinct but related topic, Derrida (1987) suggests that “it is transportation which is not without its problems and artful violence: a *logical* frame is transposed and forced in to be imposed on a *nonlogical* structure, a structure which no longer essentially concerns a

relation to the object as object of knowledge” (p.69). Though in this case, the transportation is reversed. Our non-logically evolved human frame has become a structure of logical and strategic electronic signals, small enough to be contained in a thumb drive, and still evocative of humanity. The resultant avatar is not concerned with any ideas of knowledge and this is no small violence on our humanness. The violence comes as we strip away our senses. Binary codes tears flesh away releasing red viscous blood with its concomitant scent and taste of iron. Unfeeling, uncaring bits and bites replace plasma, leaving us a cold image. So where does this take us on this journey through the educational space between the real and digital? Perhaps it is time to recognize that we “coexist with a gay parody of truth in which a world is ‘turned inside out.’” (Bakhtin, 1968, p. 95). Send in the clowns.

Technologies have always shaped educational environments and instructional policies. And, educational institutions have long embraced the avatar: the institution itself is an avatar, perhaps even a grotesque, the Hulky manifestation of the ideas of true progress, high culture, valid knowledge, and ultimately the path to a better life. The embodiment of these ideas comes in the historical picture of the dons with their tattered cloaks, the elderly spinster woman, and the absent-minded professor. We moved beyond those quaint representations to new ones as technology changed. The advent of video monitors offered the dichotomous idea of static yet moving image lecture courses with educators acting as the reproducible analog version of them. This means of repeatable storytelling mimics the storytelling that children enjoy, wanting to relive the chronotope of comfort, wanting to listen to the same story or watch the same Disney movie over and over. There is succor in the stasis of the story. Computer technology allows for digitized

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enhancement for RSS feeds, and podcasts, and at your leisure, education, which is again repeatable. Online courses now offer an array of methods of instruction, some requiring real time chats while others require no interaction but merely a series of assignments for completion.

Now education is changing to accommodate and incorporate the gamers' version of digital avatars. Harvard Law School was the first university to introduce classes in *Second Life*® by currently offering a course on “cyber law” “to work on the forefront of important issues central to cyberspace, especially issues of digital freedom, open online education, and restorative justice” (“CyberOne,” 2008). This seems a natural evolution allowing students to be immersed in the very culture and environment which emerging legal precedent will effect. Perhaps more interesting is the decision by Glasgow Caledonian University faculty to have student nurses use avatars and virtual patients to hone their diagnostic skills. The goal is to “allow the student nurses to practice their theory in a safe environment without fear of making mistakes” (Tweddell, 2008). This is an adaptation of a program used by surgeons to improve their skills, though a 2004 report by the National Institutes of Health (NIH) suggests this technology is still in its infancy.

If we consider that this experiment is one step removed from the real experiments that students will perform once they reach the hospital setting, with real patients it can be a useful tool. Virtual patients are not real patients with real heads and real hearts and real human contradictions. But isn't it better to have them practice a bit before the real work (or real experiments?) on real people begins. Alternatively, I perceive a real danger as student nurses begin to trust too much this virtual world thereby diminishing the role of the real person in the real world. The VR patients never throw up on nurses' new shoes.

Is it live and tactile or digital and dead? As these virtual theatrics are enhanced with the haptic and proprioceptive capabilities, the realities become even more entangled. I think we need to be highly cautious and examine what are the moral responsibilities in the relationships with these virtual selves and virtual patients.

We have long considered various representations as valid avatars for real persons, and as the absent minded professor has shown us, the reverse is true too. But a new and possibly dangerous avatar is arriving. Emerging from the No Child Left Behind Act, a well-intentioned political enforcement of educational principles, is a structure of testing and educating that has finally been reified into a feedback loop. All good intentions have been forgotten. Of course we have all heard the cry that we are teaching to the test, and this does appear to be true. But instead of pushing back, educators are falling into a strange complacency that is frighteningly reminiscent of Ira Levin's novel *Stepford Wives*. In acts of seemingly blind conformity, teachers, but more frequently administrators, have been shifting toward a curriculum that is aligned by date, day and time. This arrangement allows for all teachers to be united in thought and deed and transcript. On the third Thursday of social studies Block One, the entire eighth grade class will be on page 73 of their texts...in every school...in every district...in every community. Each teacher becomes the human incarnation of some unnamed education deity and will be performing with teacher proof materials. We are in the process of creating the Stepford teacher avatar for a Kafkaesque version of the banking approach to teaching and learning. We are ignoring from Hayles' admonishment that posthumanity remain embodied and also to be conducive to enhancing human existence. Are we leaving behind the human that has free will, consciousness, and a penchant for

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communication? If so, what is it we are moving towards? Is this the meaning we intend for posthuman interactions?

Hayles (2005) with her creativity of literary analysis attends to this seemingly dystopic scenario by examining “‘intermediation’ that is, the complex transactions between bodies and texts as well as between different forms of media” and refuting the “either/or choice between media effects and a human lifeworld” (p. 7). And it is not an either/or choice because the transactions occur daily and we must remain attendant to the “irreducible complexity of contemporary posthuman configurations as they continue to evolve in digital subjects and literary texts, computer programs and human mindbodies” (p.7). By looking at the complex and fluctuating and ever evolving associations we can begin to understand how those relationships change the context of our educational environments. We can move without fear of the nightmarish scenarios imagined in science fiction and be attendant to the effect of those changes.

Hayles uses the interspaces of literary analysis, technology and media studies to proclaim the imperative of remaining embodied. But her connections between chaos and information are what resonate with me most strongly. In *Chaos Bound* (1990) she explains how people will find innate recognition of the underlying pattern in a string of numbers when asked to

‘count by twos’. By contrast, suppose I send you the output of a random number generator...Every number comes as a surprise; every number conveys new information. By this reasoning, the more random or chaotic a message is, the more information it contains. (p. 6)

But in spite of each numbers' novelty, "they do not *mean* anything" (p. 6, emphasis in the original). You cannot continue the sequence, in spite of having an extraordinary amount of information, precisely because there is no pattern. This exemplifies the objection I have to the current state of science curriculum. We give students a list of facts without any contextual understanding. Osmosis, feedback loops, polysaccharides, diffusion; memorize the definitions and rather than an understanding of their own bodily functioning. Students see facts as seemingly random bits of data without any *meaning*, without any personal context except as transferable to a test.

Beam me up Scotty. We might as all leave this holoclassroom; the students have beamed their brains elsewhere...onto another planet or perhaps into *Second Life*®, leaving behind a body slumped in their seat as a Cartesian exemplar. Maybe we should anchor these facts to context of the students so as our students' minds travel via daydreams in the classroom so they are able to take some useful bits with them? Why not tie them together with colored bits of balloon strings?

Djigit: Brave Equestrian

The Djigits are trick riders, performing feats of skill and bravery, leading to the term being used to refer to brave persons in general. I think that Bruno Latour (1979, 1993; 2005; 1979) makes another brave equestrian. His skillful riding does no damage to the myths of science but instead he uses his arsenal of language to shove some of the old images aside to accommodate a more "modern" view. He uses anthropology instead of six-shooter explosions to examine the "social construction of scientific knowledge" and

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in so doing explores the nature of idolatry in and of science. The idols of Einstein, Edison, and Newton are still evident and still worshiped.

Even when I stood before a classroom, as a scientist, students described the scientist ideal not as an elusive avatar but instead as an idol of a brilliant white male with messy white hair and a white lab coat. Gender issues aside, while there is no indication that Newton or Edison wore white lab coats (mine was black with orange batik) nor do they appear to have unkempt hair (my grooming is not at issue), the image prevails. The idea too is that scientists think things up whole and only the lack of sufficient technology keeps us from achieving our goals. Latour (1979) helps to dispel that idea, but not without some hard fought ground. “[T]he fact that scientists often change the manner and content of their statements when talking to outsiders causes problems both for outsiders’ reconstruction of scientific events and for an appreciation of how science is done” (p. 28). Scientists are shape shifting and acting the illusionist as they try to explain the results of events without describing the events. Perhaps this is what gives rise to the icons and idols of science? We humans like to create order from chaos. So, perhaps in order to get a handle on who these scientists are, we categorize them with finite characteristics.

In his work as an anthropologist and specifically as a sociologist of science, I think he recognizes both the dangers and delights of idolatry. He addresses these ideas in the fantastic text *Iconolash* (Latour, 1979) based on an exhibition.

What has happened that has made images (and by image we mean an sign, work of art, inscription, or picture that acts as a mediation to access something else) the focus of so much passion? To the point that destroying them, erasing them, defacing them, has been taken as the ultimate touchstone to prove the validity of

one's faith, or one's science, of one's critical acumen, of one's artistic creativity?

(p. 14)

Latour might well be describing djigits, who with horse at full gallop would wedge one foot into the stirrup and throw themselves off the horse, head dangling close to the ground in a Cossacks drag. He himself was instrumental in breaking down the iconographic ideal of the scientist by introducing context. Turning the image of the equestrian on its head, he shows us a new image to be considered.

Cyborg Circus

I think best in wire.

Alexander Calder

I don't try to describe the future. I try to prevent it.

Ray Bradbury

Alexander Calder loved the circus. After spending two weeks following the Barnum and Bailey show, he came home to construct a circus of his own. Using bits of copper wire, cork, and string he used his unique talents as an engineer and an artist to capture the dynamic movement of bodies. Incorporating his understanding of statics and dynamics into his joyful appreciation of the human form he created circus cyborgs made of wire and human skills.

There were trapezes and flying swings. And there was an astonishing variety of figures made of wire to represent all the animals and performers. There were

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downs and trapeze artists, acrobats and tumblers, horses and bareback lady riders. There was almost everything that one could think of to make a circus complete, and all of it was constructed of wire. (Wolfe, 2011, p. 258)

It was said that Calder always spoke about his artistic creations in the language of an engineer, describing torques, vectors of motion, and cantilever effects. “Such language would not be out of place in an engineering textbook or in a patent specification” (Petroski, 2009). But his images and sculptures often had silly or funny and childish names: *Button Flower*, *Gallows and Lollipops*, *Big Crinkly* and *Ordinary* (which is anything but). His sculptures invite you to play, and to be playful, with wire, and wire-walkers, with ideas, with language and thought.

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Calder redefined the language of sculpture, inventing mobiles and stabiles, intersections of engineering and art. Describing the spaces of intersection of science and culture might also require some redefinition. Donna Haraway (1989b, 1994, 1997, 2004) artfully uses the language of the cyborg to dismantle the hierarchical boundaries inherent in the binary system of science and society. While Haraway has not placed the cyborg in the circus, it is nonetheless circumscribed into an enclosure. The cyborg is the fusion of

natural and artificial systems. The cyborg unites the divisive differences of mind/body by allowing technology to act as intermediary, to merge machine to mind and body. She captains us away from the difficulty of trying to tease out the threads of definitions of “science” versus “technology”, a divisive argument important to those who feel the loss of self in the systems of technoscience cyborgs. She is instead balancing the teeterboard, taking weight of knowledge from the poles and moving it into the middle space by taking responsibility and being “responsible to primatologists, to historians of science, to cultural theorist, the broad left, anti-racist, anti-colonial, and women’s movements, to animals, and to lovers of serious stories” (1989a, p. 3). Within this new epistemology, science and technology are integrated components of a cyborg. We find it difficult to remember that the sciences of kinesiology, anatomy, and physiology are all necessary for the development of artificial limbs. No longer do we apply the scalpel to the previous divide of “pure” versus “applied” science. We do not have time for such squabbling in the high-stakes game of technoscience, it is moving forward quickly and it will not serve us to do an autopsy.

The cyborg recognizes that the “pure” pursuit of knowledge for its own sake is not so pure, but instead is an amalgam, and difficult to separate. There is always an end product. It may not be visualized at the time of inquiry, but it is the specter that drives creative grant writing in science labs across the US. Intertwined is the understanding that scientists, engineers and technologists will use this knowledge to produce tools and processes that will in turn be used to turn resources into goods and services. These goods and services are to solve practical problems and extend human capabilities. This is a möbius strip of compatibility; science makes technology possible, and technology makes

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doing science possible. Science is essential and attendant to technology. And the reverse is clear as well, with humans offering to serve as handmaidens, much as the humanoids served the Borg in *Star Trek*, with no apparent recognition of the loss of self in the system.

Cybernetic models allow a new way of thinking about interacting ideas or disciplines. For example, it illuminates the changing response to environment that is evident in evolution and the feedback loops of the nervous system. The language of the cyborg is not the same for everyone. Richard Dawkins (2006) too describes a cybernetic organism when he says, “We are survival machines—robot vehicles blindly programmed to preserve the selfish molecules known as genes” (p. xxi). Further, he claims that the “individual organism...is not fundamental to life, but something that emerges when genes...gang together in co-operative groups as selfish “co-operators”” (pp. 308-9). We should examine the language he uses. These are reductionist ideas and dogmatic statements that serve to frighten and alienate rather than explain the evolution of species. Having turned us all into dispassionate cyborgs, those of us with passions (all of us I would think) decry this push to what Dawkins is calling rational and scientific thought. Now to be fair, while he considers the gene the prime mover in this historical dance, he does allow that we can be taught to be moral, ethical beings, in spite of being genetically programmed for selfishness. He assumes the rigid demeanor of the logical Vulcan and claims ownership of reason and knowledge. He claims that “science is the only way we know to understand the real world” (Dawkins in Midgley, 2006, p. 9).

But of course he is wrong. First, it is absurd to think that science is the only way we understand our world, and second, how did Dawkins, an Oxford trained ethologist and

evolutionary biologist turned authoritative author on all things related to rational secular behavior, become the arbiter of what reality means for all of us? And lastly, the area of science that Dawkins investigates is in fact still being investigated. While he has his supporters, other distinguished scientists in the field, including Stephen Gould, Thomas Kaufman and Richard Lewontin disagree with Dawkins. He is a man climbing into a rigid model that even Descartes with his constant musing had abandoned. I invoke Dawkins, first of all because his contribution to evolutionary biology is brilliant and noteworthy. I also find him a clear and poetic writer. But his rigidity also serves as a counterpoint to Haraway's insightful, playful use of language to invite us into the interspaces. His strident tone may be a reflection of his frustration at the constant bombardment of science education by creationists who want to hold supernatural court in the natural world. But his intransigence reflects the model of how science is presented to students and society; he invites you into his cell claiming it as the space for the right thinking, angry at the rest of us for not falling sway to his point, ultimately alienating those who might otherwise be inclined to listen.

Echoing Hayles' work in traversing the space between the technic and the human, similarly, Mark Hansen's (2006b) book *New Philosophy for New Media* explores the spaces within embodiment and media. Where Hayles' focus is on literature, both textual and electronic, Hansen's exploration is different in that he analyzes technology and specifically digital representations at the interface with humanness. Hansen is looking at the idea of embodiment "as inseparable from the cognitive activity of the brain" (p. 3), or more specifically as embodied perception. Paying homage to Walter Benjamin's (2008) marvelous work on how art has been transformed by the technologies that make art

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reproducible, he expands on Benjamin's notion of 'Technik', which broadly incorporates the difficult ideas of technology, technique and technics. In attempting to unravel this tightly wound cord, Hansen (2006a) examines the "coevolution of the human with technics" (p. ix). For Hansen, technology in this dance of coevolution is not something that is just an add-on to life experiences, but Hansen insists that it "must be understood to be a constitutive dimension of embodiment from the start" (p. x). His technological focus is the computer and the human-techno interactions with and within computer media.

Though his language is often abstruse, I think he helps to pull apart the ideas of interactive and integrated technologies that shape our understanding of the world, as well as the counterpoint to this, which is that our understanding of the world helps us shape technologies and how we *want* to interact with them...*we see them as we are*.

Hansen's work brings to mind *The Veldt*, a short story by Ray Bradbury (1951/1982). The story is told on the body of *The Illustrated Man*. The Illustrated Man has been ousted from every circus and carnival he has worked for. His tattoos, while vibrant and compelling are simply too animated. One of the tattoo's stories opens with a bit of technical trouble in the idyllic home of the future. A family of four has carved out a life in a house equipped with all the latest technology, technique and technics. The most expensive feature is the nursery that can be thought into any environment desired. This device has been more recently reinvented as the Holodeck on *Star Trek* and in military think tanks as a prototype for military training. The house and furniture all have features that provide all the necessities, and in fact, render the parents in the story useless. "But nothing is too good for our children' George had said" (p. 7). This perfect existence turns sour as the parents try to turn back the clock and turn off the technology that they and

their children have come to rely on ...to tie their shoes, to paint their pictures, to rock them to sleep and give them comfort. The children, with the help and love of technology, kill their familial flesh in order to continue the mechanistic idyll.

Bradbury in this and several other stories tries to show why he feels the barriers between humans and technology should remain more fixed and rigid, or at least under constant scrutiny. In spite of Bradbury's dire warnings of a catastrophic outcome, technology does continue to move forward, though we are left behind with a sense of apprehension about our relationship with a system that seems to move forward at its own insistence. This apprehension may be what Hansen is trying to assuage. What we know is that the dividing line between technology and ourselves is highly permeable. Technology is ubiquitous in our lives either in the form of transportation, our medial devices and pharmaceuticals, or the myriad images with which we daily interact. Hansen recognizes this flexible interface and confronts how we can and do interact with technology in all of its glorious forms. Hansen spends a good deal of his considerations on interactive images that are digitally driven. Some of these works resemble a primitive holodeck environment, even incorporating a haptic experience, where the *perception* of touch induces an embodied experience. This is similar to the technologies used in the virtual nursing program mentioned earlier. Hansen (2006b) echoing Bergson argues that the "body functions as a kind of filter that selects, from among the universe of images circulation around it and according to its own embodied capacities, precisely those that are relevant to it" (p. 3). In other words we see these images as *we* are. Our interactions with the image are embodied perceptions. Certainly his work, like Calder's opens up different ways to examine the relationships we have with technology and the arts, and

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opens our minds to considering what new avenues might lead to fruitful ideas for developing future learning environments. And like Bradbury, it may also allow us to recognize that futures we are creating may not be in our best interest, or may not show us in the best light.

Conclusion

“I think and think for months and years. Ninety-nine times, the conclusion is false. The hundredth time I am right.”

Albert Einstein

Our world isn't a single entity of course, but a composite of many smaller worlds. From continents to nation states, right through to the world of every individual person.

Buzz Aldren

As stated at the outset, we continue to educate as if the student is a *tabula rasa* recipient without any preconceived notions about how the world works. Both students and teachers come into a classroom with preconceived and myriad valid prescriptives for negotiating life's spaces. We ignore these facts at our peril. Not only are the students bored, but teachers are as well. We alienate everyone from the magic, mystery and intrigues of science but also we prohibit them the use of valuable lifelong tools for informed contributions and thoughtful participation in society.

We have to acknowledge the legacy of Descartes and Kant and their valuable contributions to the wealth of science and philosophical ideals. But these ideas are

outdated; we have to acknowledge that in this 21st century, we have to foster creativity. We should encourage methodical analysis and problem solving skills embedded in the scientific method, but we also have to help prepare students to function effectively in a rapidly changing information economy. By looking at the intersections of the arts and sciences we can encourage democratic, ethical and critical thinking. We should build bridges, blaze new trails and launch spaceships to travel to outer space to foster our inner spaces filling them with creativity, hope, entrepreneurship, resourcefulness and ingenuity. We should use all the tools at our disposal. I think if we continue to act as if sharp dividing lines are necessary, we get caught up making problematic distinctions. We end up...well... losing Pluto as a planet.

Before we land this space ship and role the credits, lets take a quick look around. Once seen as emissaries from the gods, each planet has different characteristics. Our own beautiful blue world is the only one which has multiple identified life forms. Earth knows Venus as our sister planet because of its similarities in mass, density and terrestrial nature. Named after the goddess of love and beauty she is cloaked in swirling clouds of scorching sulfuric acid gas. Saturn is remarkably distinct with its seemingly solid skirt of moons, moonlets, gases and dust and debris. We have Uranus, Mercury, Mars, Neptune, and Jupiter, all with very distinct natures. Pluto too was a planet from 1930 until 2006 when the International Astronomical Union (IAU) defined the term “planet” for the *first* time. By limiting the definition of planet, they kicked out some skygazers’ mascot. Small, distant and a little goofy, Pluto was beloved by school children everywhere as some science they could relate to. Spoil Sports. I think they made up new rules just to keep the pipsqueak off the team.

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The same is true of trying to distinguish when we set down harsh rules about what separates the worlds of art from the worlds of science, particularly in our ideas about how to educate. It is not about either/ or, but a more inclusive idea of accommodating both poetry and science sometimes in the same inhalation of air and exhalation of beautiful molecular CO₂. We have to continue to look at the possibilities of the world, “from continents to nation states, right through to the world of every individual person” (Aldrin in Myers, Isherwood, & Saatchi, 2006, p. 14). We should learn to speak Klingon, and Farsi, and Spanish. We should embrace art and science and history so that we can recognize the obstacles of the past, and take as many paths as possible to move us into the future.

CHAPTER 5

CIRCUS OF THE SEA

One important context of currere is political.

William Pinar

Science as currently perceived by much of society is something distant and distinct from current culture as a whole. Science is looked upon as an activity performed by an elite, isolated and somewhat mysterious group of individuals. Everyday citizens do not consider science as something that affects their daily lives, or that it is necessary to become more familiar with. But we take medicines, use iPods, drive cars, all the while taking advantage of scientists' understanding of evolution and chemistry, propulsion and physics and sound waves and electromagnetism each time we do so. The examples are simplified, but do represent the breadth of science ideas that infiltrate our lives daily. We ordinary folks expect scientists to behave ethically and to think responsibly about the ways they shape our culture. We believe that they tell us a true story. But this is not always what happens.

With each amazing new invention or discoveries we find that the headline for the story told is usually one-sided. I retreat to the past for a persistent example. Paul Hermann Müller, a Swiss chemist, discovered that the chemical polymer DDT was a highly effective insecticide. DDT was such a miracle of insecticides, killing agricultural pests and ultimately preventing millions of deaths worldwide from malarial mosquitoes. However, it effectively killed all insects in its path including the insects needed for crop

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pollination. Though beyond the scope of this chapter, the excessive use of DDT²² was held responsible for a decline in bird populations and has been linked to several types of cancer. Recognized as an environmental hazard as early as the 1940's by Rachel Carson, it was finally brought to the forefront of US public and political concerns by her 1962 celebrated book *Silent Spring*. Its use was not banned in the US until 1972. We have not heard the last of this deadly poison yet. It is still approved for use in India, China, South America, Africa, and Malaysia. It is delivered as a fine powder, which is then transported, by air and surface currents reaching as far as the Antarctic. As the glaciers melt, as a presumed result of other human folly, they are re-releasing the chemicals into our coastal waters, and making their way back into the food chain.

Our reliance and expectations of science affects how we feel morally and ethically about quality of life issues. We made the decision to be freed from bother and sometimes death from mosquitoes. We made and continue to make the decision that the lives of humans are worth more than the lives of other species that share the planet with us. We expect science and technology to thwart all natural disasters including our own deaths. We made the choice to use this exceptional chemical and others like it, using our human comfort to dictate whether the substance is used or banned. We are sometimes too slow to recognize that our interference with nature will have natural and sometimes dire consequences. As we continue to produce new and seemingly effective chemicals and

²² This chapter is not about DDT specifically which has been shown to have enormous benefits. Its initial "miracle" status delayed a more complete analysis of the benefits and the costs for nearly three decades, which might have effected more environmentally effective applications.

medicines, introduce new technologies, and accept new scientific ideas as cultural benchmarks, it is really time to talk.

The ideas in this chapter are two fold. First, Science education has not changed to address the needs of citizens in the 21st century. Second, because of the pervasive and sometimes insidious nature of science and technology's effect on ethics and culture we need to help the public to understand how science works. In order to have a more just and democratic world, I believe that science literacy is paramount, so a democratic dialogue can take place. I also believe the way to achieve such a dialogue is bring new and more textured stories to the commons. Curriculum theorists have a special obligation to help our fellow citizens navigate within an increasingly complex world. I believe we should live in a just world. I believe that kindness and caring are necessary to achieve that. I believe that we need to interconnect the humanities and the sciences for a more complete understanding of this complex world. I believe we need to consider culture and community as an integral element in the life science curriculum, and I believe we can do it (for some) through stories with an intersecting curriculum of the arts and sciences.

Intersections

Taken concretely, the experience of convergent lines contains within itself the elements of the transformation of its own content.

(Dewey, 1977, p. 164)

I do not know when I made the conscience connections between science and the arts. I am certain there was not a single clarifying thought about the apparent converging

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lines of the two disciplines. I began my story in creative world of theatre and circus arts, but as my life unfolded, I took what seemed to be an entirely separate trajectory, returning to school to become a scientist. My husband and I often joke that this was a natural transition from art to science, but it seemed and still seems a bit fantastical to anyone outside our circle of friends. C. P. Snow, the author of the famed *Two Cultures* once remarked that he did not notice any incongruity between “culture based on the classics and the humanities... and the scientific culture that has developed over the last two centuries” (Snow, 1960). As a practical matter, he chose to start his career as a scientist, which at the time was a more lucrative way of earning a living. He became an educator and finally a writer (though I would not remove his educator mask with this change in character). I had a bit of the reverse situation. I moved from the arts to the sciences and finally to education and writing. I always loved science in school, but I did not recognize that you could do science for a living, so I leaned towards the arts. What could it mean to do science? I at least had some family members who were “in the arts”, so at least I knew what that looked like. I actually did not know what *doing* science meant. I did not recognize that I could do science! It was certainly too abstract to extrapolate the *doing* science from what I was hearing in the classroom. This disparate understanding of what science is or appears to be, is part of why I want to look at the issue of using the arts to teach science and bridging the space between the two cultures.

While I invoke Snow, I think we need to remember that his image of culture was a more elitist view than the one I am considering. He was, at the time he was writing, a member of the upper class, a previously successful scientist, a very successful businessman, and an acclaimed writer. The cultures he considered in the split were the

literary elite and the scientific elite. I am not negating his valuable perspective, neither am I overlooking his incitement of a spirited and productive discussion. In fact he states very clearly the identity of the two cultures of his concern. In point of fact, while he was talking about the two intellectual communities his ideas were sometimes more broad in scope. “In our society (that is, advanced western society) we have lost even the pretense of a common culture...[t]his is serious for our creative, intellectual and, above all, our normal life. It is leading us to interpret the past wrongly, to misjudge the present, and to deny our hopes of the future” (Snow, 1964/1993, p. 60).

It is this broader scope that appeals to me. In this chapter I am suggesting that the two cultures I am considering are somewhat more populist in nature. They are: 1) scientific education community, which includes scientists, journalists, bloggers, and teachers (who may or may not be scientifically trained) and 2) everybody else. I realize the “everybody else” is rather big which is why in this chapter a whale will accompany me. The “everybody else” is the public who has lost the “pretense of a common culture”, but is affected by the impact of what David Suzuki (2007) calls the “hidden force on society” (p. vii). The idea that science is a *hidden* force in this age of information is astounding, but the consequences of that blindness is apparent as we see the impact on culture as we witness the consequences of sciences’ veiled presence as genetically modified foods made a stealth visit to our supermarkets. It is also apparent as medical advances become commonplace; that the idea that millions of human heart valves have been retrofitted with pig parts now goes unremarked. As nanotechnology and stem cell technology are working themselves into our culture, what should we be talking about? Should we be considering if and what deep ocean we are swimming in and what dangers

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might lurk? Our society grapples with issues of evolution, climate change, nanotechnology, stem cell technology and genetically modified foods, to name just a very few. What is problematic here is that “too often, those who have the power to act are ill equipped to assess the technological and scientific information they need” (p. vii). Those who have been elected to represent us in the ethical debates about what and where and *if* these emerging technologies should be used, are themselves products of the existing system and culture of scientific communication. They do sometimes misunderstand the relevant facts, or sometimes, more sadly, they choose to distort them. But teachers and journalists who are disseminating information to the public are also often misinformed. One need only look at the story, framed by politicians, but presented by the media, to push a creationist agenda as a scientific debate. There is a false debate taking the place of the one we should be having. As the pace of scientific innovation and applications increases, the time for scientific literacy is now.

Scientific literacy is not a collection of facts, but an ability to comprehend, create and communicate ideas. And as internal observers with only partial views we must join forces to expose a more complete picture of how our society is being shaped. This requires all the views at our disposal. My life experience has been a polymer of disciplines and cultures. So my intended research topic is to examine the spaces where apparently disparate disciplines intersect.

Cast Introductions: Whale Tales

When you invite a whale into the story inevitably Jonah will appear. It is told that Jonah was swallowed by a whale when his shipmates cast him overboard. They blamed him for the storm that was threatening their craft. They were right to in their assessment, since the storm was God's handiwork in retribution for Jonah's disobedience. The whale was God's idea too, to give Jonah a little time to see the error of his ways. Jonah was grateful when the whale threw him up onto the shore of an island, and while a little worse for his three days of contemplation, he went on to do as God had initially asked. The veracity of the story has been debated for centuries, but I am just reporting what I heard.

Besides Jonah, of course, we have the whale. In this story it will be a narwhal, not the debated big black fish of Jonah's story. These unique mammals live in the deep waters of the arctic, carefully eluding all but the most dedicated and dogged of scientists. Besides their elusiveness, the appearance of a five to eight foot "horn" adds to its mysterious nature. But, we will have more of this anon. We begin our adventure with a parable.

Is That a Life Boat?

A man in a boat began to bore a hole under his seat. His fellow passengers protested. "What concern is it of yours?" he responded, "I am making a hole under my seat, not yours." They replied, "That is so, but when the water enters and the boat sinks, we too will drown." (Rabbi Shimon bar Yohai in Sacks, 2005, p. 84)

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I tell you I did not know when I made the connections between science and the arts, but I do remember the moment I knew something had to change in my approach to science education. I fell asleep while teaching. Oh ... ok... not literally, but I was standing before an introductory biology class, sailing along, waxing eloquent about the marvels of photosynthesis, and I suddenly realized I was thinking about my grocery list. I was talking about one of the most astounding processes in the natural world, a process that captured my imagination as a student and lured me into the sciences with seduction of a Siren. Lulled by the science song, though not cast on the rocks, I was definitely taken off my plotted course and delightedly chained myself to the mast of science for many years. Suddenly, I was writing bread and eggs on my mental list while explaining an extraordinary world-shaping, life-on-earth-as-we-know-it concept. I looked out and they were bored. What was infinitely worse was that I was bored, boring ...and boring a hole under my seat. So how could this be that we were all riding this tidal bore? This was HUGE. My boat had capsized on the shoals...my students were drowning in the constricting waves of scientific jargon and I was in the belly of a whale. Had that been a whale song and not the sea-deity I heard those many years ago?

In the Belly of a Whale

The most beautiful thing we can experience is the mysterious. It is the source of all true art and all science. He to whom this emotion is a stranger, who can no longer pause to wonder and stand rapt in awe, is as good as dead: his eyes are closed.

Einstein

Finding myself in this mysterious space I am forced to pause and wonder at the road that brought me here. I choose as my captor *Monodon monoceros*, the narwhal. This unicorn of the sea with a left handed helical horn has mythical properties that I need for this adventure. Bachelard (1958/1969) uses this helical image to describe how we experience intimate spaces, saying, "...what a spiral man's being represents. And what a number in invertible dynamisms there are in this spiral! One no longer knows right away whether one is running toward the center or escaping" (p. 214). The spiral allows for inside/ outside analysis while acknowledging some nebulous but decided difference. In the belly of the whale, acknowledging my spiral being...Inside I am safe and warm, coddled by scientific certainty, comforted by facts and a position of power; outside is revealed as the chaotic mixture of cultural irrelevance and an uncertainty of my position. But inside can also be a prison. Trapped inside with swirling administrative alphabet soup of sacred cows of AYP, AMAO, DIP or NCATE the outside with eyes wide open we find freedom of thought, or perhaps an evolution of ones ideas, a contemplative distancing from formulaic responses.

Sacred Cows

SACRED, adj. Dedicated to some religious purpose; having a divine character; inspiring solemn thoughts or emotions; as, the Dalai Lama of Tibet; the Moogum of M'bwango; the temple of Apes in Ceylon; the Cow in India; the Crocodile, the Cat and the Onion of ancient Egypt; the Mufti of Moosh; the hair of the dog that bit Noah, etc.

Ambrose Bierce

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Acknowledging Donna Haraway (2008), who has “written from the belly of powerful figures such as cyborgs, monkeys and apes, oncomice, and, more recently, dogs” (p. 4), I rephrase the opening lines from her book *When Species Meet* when I ask, Who and what do I touch when I am in the belly of my whale? Do I touch our evolutionary history when I meet with the mesonychids, the presumptive ancestor of whales, hippos, and cows? Do I get to witness that creature moving back into the soothing waters and leaving behind its terrestrial incarnation? My ancestors were not present to witness the ancestral carnivorous ungulate whose four limbs are now altered by evolution to accommodate their watery existence. Does the spiral of DNA lead me back to the extinct order of mammals that gave rise to the narwhal or forward to the future? Will this historical bond remind me of my own history?

Writing from the belly of the whale, we are touching each other. The meeting of our flesh to flesh... of mind to mind...history-to-history...what should my touch convey? Narwhals, already rare, are continuing to be hunted for food and global warming is diminishing their territory. Narwhals also continue to be affected by the over fishing of their food sources. There is also new evidence suggesting that sonar activity by fishermen and the military affects breeding and navigation. As the chimera whale-woman perhaps I can find the whale a place to hide so she too will not become extinct? Or as whale-woman can I enlist others to help by explaining the plight of my new self?

As whale-woman, who and what do I touch when I touch others? Should I touch their minds, gently so they might see the “*world in a grain of sand/ And a heaven in a wild flower*” (Blake, 1880). Should I enchant them with stories of my life spent in the lovely benthic pools of the Arctic pole? Should I tell them of my ability to dive deeper

and longer than any of my water dwelling relatives? Should I touch their hand softly so as not to startle. Or should I poke with my hard narwhal tooth to cause the sharp intake of breath, to have them fill their lungs with the effluvium of modern life?

In my whale-woman guise, it is time to speak or sing of their relationship to human and non-human species. Though I will do no violence with my twisting tooth, it is time to sacrifice the sacred cow of human domination over nature. It is time to remind them of the interconnected relationships and ethical obligations that this relationship demands. Does the spiral of the DNA we share take us back far enough in evolutionary story to see the divergence of molecules distinguishing us from plants by only minor structural differences? The construction of hemoglobin and chlorophyll both start with a ring structure; the pathways diverge where the metal ion is added, iron for hemoglobin giving us varying shades of blood red, magnesium for chlorophyll filling the landscape with brilliant displays of green. While we inhale oxygen and expel CO₂, plants are doing the opposite. It is a marvelous molecular ballet of interdependency. Can we linger here and play making links to the chemistry of life or should we just have everyone sit still and memorize the periodic table?

As whale-woman, with my body as ninety percent water, I am structured by one hundred trillion human cells. Living with me, in me, on me, as me—there are ten times as many bacteria, viruses, and fungi. We are chimeras of multiplicities. I love the irony of this discovery as we humans continue to beat our chests with the vigor of some primates all the while declaring our superiority and distinctness from those hairy cousins. Haraway (2008) shares my love of the richness of our complicated relationship. She hears the 90 percent of her “play in a symphony necessary to my being alive at all” (p. 1). Similarly,

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Deleuze and Guattari (1987/2007) suggest that “our viruses cause us to form a rhizome with other animals” (p. 10), melding plant and animal species, creating “transversal communications ...between genealogical trees.” (p. 11). Should we pause and listen to the whales’ songs calling for a relationship with the species in us and around us...or should we memorize the taxonomic hierarchy with its “centers of significance and subjectification” (p. 16)?

Naming the Whale?

*"What's in a name? That which we call a rose
By any other name would smell as sweet."*

Romeo and Juliet (II, ii, 1-2)

As we find out later in Shakespeare’s story, a name is very important indeed. What of our taxonomic heritage? Narwhals go by many names, called *kelleluak kakortok* in Greenland and *quilalugaq* in Canada. In the 18th century, naturalist Carrolus Linnaeus set about to categorize and provide taxonomic names for plants and animals using Latin roots that referred to distinctive features of the organisms. “Naming and categorizing has concerned humans since ancient times, as the Hebrew texts attest. Whether for the most basic requirements of communal life or for the most sophisticated scientific exchanges...” (Farber, 2000, p. 1). Using this particular and authoritative language claims to allow for more precise definitions. Linnaeus called the narwhal, *Monodon monoceros*, meaning one tooth, one horn. He was forgivably mistaken as the narwhal have two nonfunctional teeth and no horn at all.

Perhaps less wrong, but no more flattering is the name narwhal itself, coming from the Norse language, *nár*, meaning "corpse", referring to the animal's white and grey mottled pigmentation, which appeared like that of a floating drowned sailor. The French, in this case more romantic than the Norse or the English, calls it *Licorne de mer* or unicorn of the sea, giving it a more mythical quality.

There is indeed mythology accompanying the narwhal, but we will spend no more time to dally there. The name with the most devastating consequences is “natural resource.” David W. Blades (2001) asks, “How does this pair of words makes sense? Is something ‘natural’ once it is considered a resource to me managed” (p. 68)? We ignore the oxymoron and move forward having decided that we are the stewards holding dominion over the recourses of the planet, both abiotic (minerals, oil, air, water and gas) and biotic (fish, wildlife and forests) as well. In the US, we have the Department of Interior to oversee the management, and conservation of all of these “resources.” This unilateral decision to “manage” comes into conflict with many species ability to thrive. Management duties include the allocation and use of said *resources*, which is distinctly oppositional to the word *conservation*. This whale of a management strategy has thus far played out with a decline in biodiversity. A comprehensive study reported in *Science* states, “Marine ecosystems are experiencing accelerating loss of populations and species...rates of resource collapse increased and recovery potential, stability, and water quality decreased exponentially with declining diversity” (Worm et al., 2006).

Who and what do I touch when I am in the belly of my whale? Are we companions destined to watch one another die? A more companionable activity might be to watch and help each other live. Can we risk losing more companions like the

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humorous dodo, or the Caribbean monk seal, both left purely to our imaginations as victims of human interference? Can we risk reenacting the scenario of Easter Island?

Though the island is remembered for those strange monolithic sentinels of silence, placed so eerily on such an isolated and barren island, the story that is silent and forgotten is that Easter Island once held a lush tropical forest. A small island, the population reached its peak of 7000 inhabitants in the 1500s. As the population grew, the forests were cleared to make clearings for agriculture. The trees were used for fishing vessels, fuel and housing. They were also used as the technology (state of the art at the time) for moving the monumental statues (moai). The islanders lived with abundant natural resources. Archeologists contend the island was denuded of trees by 1600. What were they thinking when they cut down the last tree? Biogeographer Jared Diamond (2005) in his authoritative text *Collapse: How societies choose to fail or succeed* suggests that it was not an apocalyptic collapse, but instead “creeping normalcy or landscape amnesia” (p. 426). A few trees here, next year you cut a few more...gradually changing the landscape so that “only the oldest islanders thinking back to their childhoods... could have recognized the difference” (p. 426).

No more trees... no more palms to provide nuts, honey, wine and sugar. No more shade to grow mulberries. No more birds nesting in the foliage...no more bird song. No bees in the tree cavities to pollinate their crops. No more trees, the soil exposed to the elements... with no windbreak or root systems to capture water, the earth eroded; leached of nutrients the resultant crops were sparse. No more trees...no boats from which to fish, No more trees...no homes in which to live. Cannibalism, warfare and starvation fill out

this sad and sordid story. The inhabitants of this small island clearly did not know who and what they were touching.

What strikes me is Diamond's use of the word "choose." Did the islanders choose to denude their landscape of all the things they once cherished or at least depended on? Did they know what the course that they were choosing? If they had known what they were doing, would they have continued down the path of destruction? If we share what we know...if we show them the scientific findings...give them the facts...will it help them to make more ethical decisions about who and what they are touching? Or do we tell them the story of Easter Island? Or Shel Silverstein's (1964) *The Giving Tree*? Or the story of Haiti?

This tragic story is being played out in modern day Haiti. The island was once sixty percent forested. As the result of corrupt leadership, greedy concessionaires stripped the forest to less than two percent. Deforestation was followed by soil erosion, resulting in lower crop yields and worsening droughts. The island is now undergoing desertification, which tends to worsen the effects of hurricanes and tropical storms. The whole story ends with a downward spiral in the living conditions of the islands inhabitants. How many stories do we have to tell?

Landlocked

There is a children's story by Silverstein called *The Giving Tree*. In this short tome the author describes a "loving" relationship between a boy and a tree. At first the boy loves the tree, loves to climb through its branches and play... relishing its apples and

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resting in the shade. As the boy grows he became discontented and wanted more from the tree. First the boy wanted all the apples, so that he could sell them. Then the boy turned man took the trees branches to build him self a house. Next the discontented man wants to make a boat to sail away in search of happiness, so the man cuts down the tree leaving just the stump.

When the boy returns as an old man in need of a place to rest, the tree invited him to sit on the stump. Silverstein leaves us with the phrase...“And the tree was happy.” The book is hailed as a tender story about “the gift of giving and a serene acceptance of another’s capacity to love in return” (front flap).

This story should have been called the “The Selfish Man.” This children’s tale is not innocuous tale of love and mutual respect, but a horrible harbinger of men’s actions. With stories we can evoke mood (was this story so tender?), engender skills that will give us courage, inspire joy, expand thinking and incite wonder. Stories are a way to exchange and amplify knowledge and experiences. What lessons are learned in this story? Is this really an exemplar of a loving, caring relationship? Where is the tenderness in chopping down a tree? What lessons are taught when we admire the complacency of the tree (and call it love) in the face of repeated and even surgical abuse?

Because this and other stories like it exist, and some might say, predominate, it is imperative that a counterpoint is presented. According to Haraway (1989a) due to embedded constructions based on Aristotle and “White Capitalist Patriarchy...nature is only the raw material of culture, appropriated, preserved, enslaved, exalted, or otherwise made flexible for disposal by culture in the logic of capitalist colonialism” (p. 147). The boy, as a product of his consumer culture, saw nature as his for the taking, having found

no need to consider the relationship, no need to consider his role in the destruction/consumption of nature. The story ends with the scrawny old man's curved body sitting alone without the shade of the once-loved branches, no apples to eat, no birds nesting in the branches with bright songs to sooth his spirit. In this reenactment of Easter Island, and if it was a truly hot day, ultimately I suppose he got what he deserved, though fairness is not nature's way.

As we ignore the lessons of Easter Island, and continue to play out the boy's tree cutting scenario on a larger scale in the Olympia National Forest, the Alaskan Wildlife Preserve and the rain forests of Brazil, we must consider what this story reveals and what stories should be told as contrast. More than just contrast...but perhaps we should treat this story as a call to action, a call to justice.

Bio Power

It's all a question of story. We are in trouble just now because we do not have a good story. We are in between stories. The old story, the account of how we fit into it, is no longer effective. Yet we have not learned the new story.

Thomas Berry, *The Dream of the Earth*

How and when do we start telling new stories? Confronted daily by reports of deforestation, de-greening, de-clining fish and whale populations, de-struction of natural habitats, and de-emphasis of family and community, these stories are drowning me in a tidal wave of despair. I need a new story. I am tired and de-energized, de-jected. Maybe it is time to crawl back into the belly of the whale.

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I believe in the power of story telling. It “through the stories we hear who we are” (Silko, 1996). I am not suggesting a fantasy world that allows us escape from the realities of injustice. But it is time to look at the other narratives; those that like Darwin’s narrative are emerging from the ocean of biodiversity, or like that of the whale, who is heading back in to a place where it can thrive. Of course in order to truly mourn and acknowledge the loss of so many species, we must tell their stories, and we must move forward up from that place of despondency. I think we need to collect stories of triumph, of biopower, of goodness that can be sown as seeds, planting new ideas that can grow into a community garden. Giroux (2006) reminds us of Foucault’s insistence that “the logic of biopower is dialectical, productive and positive: ‘It exerts a positive influence on life, endeavors to administer, optimize, and multiply it’” (p. 13). By adding to positive stories we can multiply the effect, supplying a life raft for those of us drowning in the wave of hopelessness.

Perhaps ecology and justice can be two of the pontoons of the raft. Lashing them together to make a firmer foundation. Though the stories of environmental devastation show that American jurisprudence does not always mete out true justice. So we must continue to counter this by continued examination and exposition. Since these stories do not stop at our borders, and in fact, as in the case of toxic waste disposal and certain chemical manufacturing, are often shipped to countries with less rigorous environmental policies and a population willing to sacrifice their health in order to support their families. Ironically, if you look at any map of oceanic currents we can plainly see that the poisons do not stay behind the border of these third world nations, but float out to sea and are recycled back to land on our shores. Sometimes they concentrate at the arctic where

the narwhals live and feed and breed, causing a domino effect of devastation through the ecosystem.

Here in the U.S. these issues are also played out, but “because environmental justice struggles are at heart political and economic struggles, a legal response is often inappropriate or unavailable...and in many instances...a mistake” (Cole & Foster, 2001, p. 129) also describe strategies that utilize community activism as a way of empowering citizens in their struggles for ecological justice. The legal system should not be seen as panacea to the fights for democratic assessment of how and where potentially hazardous industries are sited. Unfortunately, this is exactly what many people expect—that someone else, scientists, politicians or the judiciary—will take care of things. We need take no personal responsibility. But in fact it appears that there are just as many failures as successes. So we have to turn to the foundations of the environmental justice movements that include communities of activists: civil rights movement, the anti-toxics movement, academics, native Americans, the labor movement, traditional environmentalists. Since justice seems to be a bit “leaky” right now, we can add these communities as more pontoons to the raft, for when people come together they can realize their strength of collective power, learn new skills, build stronger coalitions, and forge new and synergistic friendships. With these communities as part of our foundation we have a stronger raft still.

As educators, while we watch the process of schooling moving towards more rigid explanations of how the world works, we must build a subversive substructure by including stories in history, literature, science and society where the actions of communities reveal how important it is for us to *live as if nature mattered*. We need to

cultivate in our garden a sense of ecological consciousness. We need to take back the term *community* from business institutions that are acting like drug dealers claiming they know just what we need.

Green Revolution

As many Americans are buying hybrid cars, recyclable products, and organic produce as salve to ecological destruction, we are sending our old cars, old computers, and old washer-dryers to landfills everywhere. As we give up our bottled water or at least make sure it comes in a recyclable container, there are still millions of people world-wide that do not have access to potable water, whose caloric intake is far below what is considered necessary to sustain life. These same people are the ones who are working in unregulated “recycling” plants that strip our discarded electronic equipment from the precious metals for sale exposing themselves to the toxins within. These plants are often set right next to their villages, where toxic gases fill the air and the groundwater is saturated with heavy metals. (2002). By moving our waste off shore, we are sheltered from the visions of children dying for our new I-pod. We can feel better about consuming and can ignore the hidden costs. This is the unseen cost of our consumerism, the unspoken pact we make with ourselves when we buy our way to “green.” As educators we must remind ourselves of the full costs of our actions. We must remind everyone that someone’s sister, mother, husband, or child is dying of metal toxicity so that we can live in comfort. Shouldn’t we talk about why the cost of goods excludes justice?

Because “[w]e do not live in a just world” (Nagel, 2005, p. 114) we must tell other stories of justice. We can and should reclaim education, community, environment, and justice because “the movement for environmental justice is also about creating clean jobs, building a sustainable economy, guaranteeing safe and affordable housing, and achieving racial and social justice” (Cole & Foster, 2001). I believe we can do better. I believe that once people become aware of the full costs to humanity (their own as well as others) people will demand justice. They will demand that business owners respond responsibly, they will reclaim community, education, environment and justice, because it is the right thing, the humane thing to do.

Nature-study

“In the spider-web of facts, many a truth is strangled.”

Paul Eldridge

“The ribs and terrors in the whale, Arched over me a dismal gloom,/ While all God’s sun-lit waves rolled by,/ And left me deepening down to doom.”

(Melville, 1851, p. 42)

“What is to come of Nature-teaching in schools?” asks Edward Thomas (1909)? He starts his essay on Studying Nature with this question. He confidently claims the inevitability of Nature-study saying,

Literature sends us to Nature principally for joy, joy of the senses, of the whole frame, of the contemplative mind, and of the soul, joy which if it is found

complete...might be called religious. Science sends us to Nature for knowledge.

Industrialism and the great town sends (sic) us to nature for health. (p. 66-7)

In the nearly 100 years since he made this claim, which must be considered audacious, what has happened to Nature-teaching in schools? I'm not certain, but I think his call for nature was dropped. In the U.S. race for academic achievement, school districts are opting to eliminate outdoor activities such as recess and field trips. In Atlanta, former Superintendent of Schools Benjamin O. Canada explained the policy this way: "We are intent on improving academic performance. You don't do that by having kids hanging on the monkey bars" ("The demise of recess," 2007). Poor Mr. Canada must not be getting enough exercise, or he would have remembered the studies that show that recall is improved when learning is interwoven with physical activity. In schools where outdoor play is sanctioned, some school districts have playgrounds now paved with resin-coated safety surfaces and chopped up tires. These playgrounds are filled with plastic play equipment and often have opted to eliminate the trees and grass as hazards or maintenance problems. In many poor urban school districts recess is often played on aging asphalt paving.

Besides the horrific issues of increased childhood obesity and the increase in Ritalin prescriptions²³ to subdue any play-deprived child, studies have shown that all children, including those with attention problems benefit from spending time in nature during the school day. Children and adults need time to rejuvenate and refresh their mind

²³ (see an excellent assessment in Breggin, 2001)

and spirit during the day...” joy, joy of the senses, of the whole frame, of the contemplative mind, and of the soul” (Thomas, 1909).

We are distancing ourselves from nature. We walk around plugged into cell phones or an electronic game, having apparently lost our peripheral vision and auditory abilities. No lark’s song or rustling breeze penetrates the latest in noise canceling ear buds. No startlingly red cardinal, no swaying grasses, no camellia in bloom are enough to distract from the game. Children in both urban or even more nature friendly sub-urban schools are separated almost at birth from sunshine (causes cancer) and outdoor games (too dangerous to play in the street or unsupervised). Climbing plastic jungle gyms instead of trees, a tepid ride down mildly angled slides instead of rolling merrily down grassy hills, we have a culture of kids conditioned to be afraid of soil (dirty), grass (stains) or bugs (yuck) of any kind for fear of germs or poisonous bites. It is this discomfort with nature that keeps us separate from it and grows into an ability to close our eyes to its destruction, to treat it as other. To remind ourselves about the wonder of nature, we must tell alternative stories. We must sing the names of larks, and swallows and nuthatches. We must tell croak the name *Bufo bufo*, the marvelously handsome frog that makes its home here in the south. Can the angelic whale songs of *Megaptera novaeangliae*, the humpback whale, make us find our own songs of our earth? How can you not love something once you learn its name?

In considering what dialogues might help an ethical science curriculum, there are problems that must be acknowledged and reconsidered. If science is meant to describe the natural world, then we have to ask what precisely is the natural world? We also must ask, should science alone define our relationship to the physical and natural world around us?

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Is there a scientifically measurable connectedness to all things in the tangible world?

What of the intangible? If we can't "mathmetize" (Jardine, 1988) it, does it lose its significance? Nowhere in the curriculum do we discuss the intangible connections of the world. Nowhere in the curriculum do we examine the morality or the ethics involved in being a sentient biological organism. Nowhere do we discuss the responsibilities involved in being connected to part of a larger organic web. Nowhere do we discuss either the local or global impact of our decisions. Thomas's call was dropped, but perhaps now is time for a new connection to Nature-study.

There are two predominant views of the relationship between humanity and nature. One view has us as apart from nature, the other as a part of nature, which I will discuss subsequently. In people's devotion to the former, humans are considered as made in God's likeness; so set apart from all the other creations. The Koran and many interpretations of the Bible also include a belief that god expected/ expects man (women excluded) to hold dominion over the other creatures, so to set them apart. Adam was given the task of naming; in so doing, giving him the power to use, enjoy, abuse, love or kill all other organisms. But the roots of divisiveness existed prior to the arrival of the stories in the Bible. Adorno and Horkheimer (1972) remind us that the belief in subjugation of the world is found not only in the "Jewish creation narrative" but is predated by the similar mythologies of Olympia (p.77).

Pursuing a philosophical ideal and further isolating humans from nature, Descartes picks up the mantle of separatism, suggesting that since animals do not have consciousness, we need not consider them in our actions. More currently the political arrogance of recent administrations disregards the air and water that all creatures share as

they launched over 300 major rollbacks of U.S. environmental laws...mask[ing] its agenda with Orwellian double-speak...[his] 'Healthy Forests' initiative promotes destructive logging of old-growth forests. His 'Clear Skies' program, suggests repealing key provisions of the Clean Air Act. The administration talks about "streamlining" and "reforming" regulations when it means weakening them, and "thinning" when it means logging or clear-cutting. (Kennedy, 2004p. 3-4)

With some political and religious leaders using "verbiage" to kill our understanding of the issues, to confuse or confound the people most affected by these policies, what is our recourse? "In our time language is under assault by those whose purpose it is to sell one kind of quackery or another: economic, political, religious, or technological" (Orr, 2002, p. 55). And Orr is right of course. The language is changed to reflect the convenient view of the moment. We are used to having politicians speak with forked tongues, but what steps should we as educators take to confront this quackery? What steps do we take to untangle the web of half-truths? Oceanographer Charles Moore reminds us that we had to be "*taught* to renounce the powerful conservation ethic that we had developed during the great depression and World War II" (Moore, 2009b, emphasis added). In our modern, throwaway for convenience society we are now addicted to plastics that will take millennium to degrade. We are only one of several first world nations that produce "waste that nature can't digest" (Moore, 2009b). And the problem is growing. Moore's foundation now circumnavigates the ocean, documenting the enormous amount of plastic that is floating around in the ocean, which "in some places outweighing the biomass six-to-one" (Moore, 2009a). He has documented the death of seabirds whose stomach contents consist of pretty bits of bottle caps and cigarette

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lighters. When performing necropsies on common fish at the bottom of the food chain; fully one third of the fish had pieces of plastic in their stomachs. There are whale size consequences to our continued ignorance of “throw away concept of living” (Moore, 2009b). Whales eat seabirds too, and as they move through the ocean, their mouths wide to gain nourishment, they too are likely to be ingesting plastic. We cannot condone sea-icide. So what language do we use to teach the moral and ethical imperatives of a sustainable world? What language do we use to save the sea? What stories should we tell? And why are we still hanging around with Descartes?

Not all people consider themselves as separate or distinct from nature. Some ancient civilizations viewed all objects of the earth as having a soul. Rocks, trees, mountains, or wolves were worshiped because of their beauty, usefulness or emotional significance to the people. The souls or spirits of these objects were also believed to move freely between organisms, giving rise to the Sun Clan or Lizard Clan or the Corn Clan.

There are many cultures that embrace this web of life doctrine. Native Americans (North and South) have origin stories with archetypal chimeras of animal-humans like “Spider Woman who weaves the fate of humans and animals and plants and rocks” (Estés, 1992). These First People “worship their ancestral lands...[t]he birds and animals that inhabit the land are sacred, messengers for the spirits or even spirits themselves” (Cole & Foster, 2001). The Pueblo people used communal storytelling to continue the collective knowledge that they are integral to their environment part of the “the land, the sky, and all that is within them—the landscape—includes human beings” (Silko, 1996). Meanwhile the Hindu religion teaches that humans must live in harmony with all that is

nature: plants, animals, rivers, mountains, stars and planets. Buddhists use the concept of “mindful presence”, which refers to the conscious understanding of the interconnectedness of all forms of life, and a belief that this connection yields empathy.

Empathy and the ability to understand and share feelings for others should include other species. Present day Druids believe that

[e]very part of nature is sensed as part of the great web of life, with no one creature or aspect of it having supremacy over any other. Unlike religions that are anthropocentric, believing humanity occupies a central role in the scheme of life, this conception is systemic and holistic, and sees humankind as just one part of the wider family of life. (Carr-Gomm, 2006)

Empathy is wanting in our discussions about the environment. We should sense with the acuity of the spider when our web vibrates with the touch of another. When our rivers are used as industrial toilets, we should weep, and scream, and feel the twitch as the fishes struggle with their last breath of tainted air. We should tell the stories of turtles, dolphins, and seabirds trapped by islands of plastic bags, our plastic bags. We should remember that we are not separate from nature; we are nature; we change nature and are changed by it.

Our capacity for consciousness and abstract thought in no way separates us from nature. Our capacity of analysis sometimes leads us to an arrogant illusion: that we are so special and unique that nature isn't connected to us. But the fact is we're inextricably tied. (Gore, 2006, p. 163)

Still we try to remain disconnected, separate. We struggle with the inside/outside relationship with nature. In our outside descriptions of ourselves we distinguish ourselves

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from all other organisms, again, suggesting we are “stewards” rather than participants the world. Yet as mentioned earlier, inside humans, we are home to more bacteria than we have cells in our bodies; still we pretend we are outside ourselves, separate and superior. Without these “flora” we would not survive for long, since they provide us with services we cannot do without. We forget that we are of nature; we are nature; we are inside/outside and continuous with nature. We are fully integrated, “inextricably tied”; we are all of the same elements, hydrogen, carbon, and oxygen forged from stars in the spiral of the galaxy.

Some Whale Play

A man standing on a bare stage leaning heavily against a prop harpoon. He is dressed as an old-fashioned sailor. He has on a rough linen shirt covered with a cotton waistcoat and a snug fitting padded jacket, His trousers are close-fitting and of a dark heavy tweed and fastened by buttons below the knee. The rest of his legs are covered in greyish baggy stockings with heavy leather shoes on his feet. To top it off he wears a rumpled knitted cap commonly known as a Monmouth cap. The clothes look shabby, worn and rather dirty.

A pin spot, giving the impression of standing under a street lamp, illuminates him.

Another man, wearing a tan conical felt hat and an improbably large blue bow tie, rushes up looking rather harried.

“Hey You!” He exclaims. “Are the auditions over?” (He is panting slightly and looking around anxiously.)

“ Yes, I’m afraid we’ve both missed them.”

“If I just hadn’t taken the time to find this old outfit, I wouldn’t have missed it...Damn!” He tightly twisted the big button on his red shorts. He begins to turn away.

ISHMAEL: Well, that is a rather astonishing outfit, if you don’t mind my saying. What’s your act?

PINOCCHIO: My name’s Pinocchio...and...well you know, I was in the belly of a whale once, and I thought the experience would be useful for the play. I love to play (longingly).

ISHMAEL: Well, you can set your mind at ease...it didn’t turn out to be that kind of play. Nice lederhosen, though you seem a bit long in the tooth for short pants.

PINOCCHIO: (fiddling with his buttons): Yeah, well you’re no spring chicken either, and you might have at least washed. What’s your get up?

ISHMAEL: Well I have a little whaling experience myself. Not that I ever was inside...no, no...but sometimes I imagined how it might feel when I was out in the black sea of a moonless night. My empty purse led me to spend time as a workingman on many a great whaling ship. My contribution to the play was to be my knowledge of the narwhale. I am not the scientist here, but I have heard things that are important. “The Narwhale I have heard called the Tusked Whale, the Horned Whale, and the Unicorn Whale” (Melville, 1851, p. 143). But hey, I have a better tale, a whale of a tale of madness and torment... I heard it from a young lad named Finn. The tale I tell is of acrobats and aerialists, men and women flying through the air as though wings on their backs. Jugglers suspending 100 balls at once... doing fantastical tricks better than any conjurer you’ve ever seen. And a raven-haired woman draped in the scarves of Salome,

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that none dares watch. It is said to gaze upon her beauty will make you go blind. (He sighs). Finn claims there is tiny child that dances on a slender golden wire. And an elephant so frightening...I'm told to see it is to see the White Whale. Oh, it is the splendor of yarns.

PINOCCHIO: Wow, that sounds like quite a different story. Say, there was a little bar around the corner. How about I buy you a drink and you can tell it to me. I love a good tale!

ISHMAEL: Ah sure, it is a good way to pass the time.

PINOCCHIO: Great, let's go. Say, what did you say your name was?

They begin walking offstage.

ISHMAEL: Call me Ishmael.

Stage goes dark.

Conclusion: The Tusk of the Narwhale

My whale is about to return me to the beach. And much like Jonah, the time spent inside and outside has yielded some insights. And just like the Bachelard's (1958/1969) spiral and the spiral tusk of the narwhal there are different interpretations as to what those insights should or might be. Are we "running toward the center or escaping?" Several Christian websites (Bread of Life ministries, Torrance Parish Church, bible.org) suggest the Jonah's lesson was that he should be repentant and obedient to god. I am a little more partial to the interpretation given by Uriel Simon, Professor of Biblical Studies at Bar

Ilan University. While giving credence to other interpretations, he suggests that Jonah's story is "embodying the primordial struggle between justice and mercy" (Simon, 2009).

In the center of the spiral we can remain obedient, protected from our own decision-making, bending with the weight of the curve into tighter and tighter confines. Schooling can press us into the small confining space and change the shape of our thoughts and deeds. Alternatively, if we consider the calm center inside the eye of the storm, or the tranquil beauty of the seed arrangement of a sunflower, or the life affirming architecture of the strands of DNA the situation appears less dire. Spirals occur in so many places in nature, not the least of which are the myriad nautilus shells that are scattered throughout the ocean.

What do we gain by examining the outside space of the spiral...are things more turbulent there? If I am outside the whale, I can still hold onto to the crystalline structure of narwhal's spiraling off-center tooth. While there, will I see the weighty though toothsome struggle between justice and mercy? Perhaps I should not revel, for outside the whale it becomes more difficult to ride the waves, though the sea spray and the scent of salt air are exhilarating.

What precise purpose this ivory horn or lance answers, it would be hard to say. It does not seemed to be used like the blade of the sword-fish and bill-fish; though some sailors tell me that the Narwhale employs it for a rake in turning over the bottom of the sea for food. Charley Coffin said it was used for an ice-piercer; for the Narwhale, rising to the surface of the Polar Sea, and finding it sheeted with ice, thrusts his horn up, and so breaks through. But you cannot prove either of these surmises to be correct. (Melville, 1851, p. 139)

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There have been myriad theories as to the nature of the narwhals “tusk.” Though Melville’s words were written over 150 years ago, interestingly, these same unproven theories are touted by scientists today. The only added hypothesis is that the tusk might be an appendage used for establishing male hierarchy (males have been seen exhibiting a gentle “tusking” behavior). This suggestion is noteworthy in light of a recent determination that the sensitive spiraling narwhal tooth contains over ten million neurons that carry information from the surface of the tooth to the core. Scientists are now suggesting that the dentine of narwhal may be capable of detecting subtle changes in water temperature, pressure and particle gradients (salts and food).

Can we use this highly sensitive and sensual instrument to guide us through the troublesome gradients of justice? Though not used in battle can we use this sword of justice to cut through the hubris of humanity? Can we use the image of the unicorn tusk of the narwhal to remind us of the mysteries still available for wonder? Can we use the spiral to re-turn us to our ethical nature?

Our human interconnectedness, our environment both organic and inorganic, shapes how we live, and shapes the stories we tell. It shapes how we treat other people and other organisms from spiders to whales to bees to trees. Our ecological philosophy shapes how we treat the mountains, the air we breathe, the rivers and the oceans. We must hold in our hearts ecologies so small as our tender relationship to a tree, and so big as to encompass the universe. Because we are all connected, we are forged in the spiral of space. Carl Sagan (1994) said it well, when viewing images of our pale blue planet sent back from space, he exclaimed,

That's home. That's us. On it everyone you love, everyone you know, everyone you ever heard of, every human being who ever was, lived out their lives. The aggregate of our joy and suffering, thousands of confident religions, ideologies, and economic doctrines, ... Our posturings, our imagined self-importance, the delusion that we have some privileged position in the Universe, are challenged by this point of pale light. Our planet is a lonely speck in the great enveloping cosmic dark. In our obscurity, in all this vastness, there is no hint that help will come from elsewhere to save us from ourselves. (p. 6)

Every mother, every father, every child, every spider, every bird, every whale!
We are all related by stardust and stories; we all use the “pale blue dot” as home. A pale blue dot nestled in the swirling spiral galaxy we call the Milky Way. By soiling our nest, by using the ocean as a trashcan, we do harm to ourselves and to everything around us. We must find stories of courage and renew the connections, stories to strengthen them, stories to help us find our path to an ethically sustainable future. We must continue to try to improve our understanding of the natural world through the medium of art, the medium of circus, the medium of science, through the medium of curriculum... a polymer of understanding. We must then gather as internal observers recognizing we have only partial views and must join forces to expose a more complete picture of the shape of our society. We must save ourselves.

PARTING THOUGHTS

When I first came to curriculum theory, Dr. Marla Morris told us that essentially there is no hope. Many of us argued with her mightily, as we were still enthusiastic in our quixotic quest for and belief in change. But as it turns out, she's right. There is no hope. Which is why we must continue to trudge through the morass and look for a circus. The circus is a healing place, filled with optimism and perseverance. In the circus we are all aerialists wide-awake in the vision. We can all balance a tuba on our chin, or find empathy for the clown who can't. We are all fairy princesses who can fill the ring with pirouettes in the company of dancing monkeys²⁴. The circus taps into our inherent creativity so we can use the arts as a way of transcending.

John Dewey wrote that education was a “necessity of life”, insisting that it is a source of continuity, growth, and rejuvenation. I write that circus is a necessity of life. My engagement in a circus curriculum and the resultant complicated conversations have provided me access to a wellspring of evolving continuity, growth, and rejuvenation.

During the process of writing of this dissertation I explored the intersections between the cultures of arts and sciences, attempting to link them together in narrative polymers reflecting the need to blur the boundaries. My objective is to bring to the curricular table a new thread of conversation, which I have not seen explored in depth in our field, specifically that of integrating arts and science in education. By introducing the circus as nucleating agent, I was afforded two important opportunities. First, since the

²⁴ No real monkeys were harmed in the making of the Pickle Family Circus. The only monkeys in the Pickle's were those who donned the very hot costume.

circus is a shaping force in my life story, it allows me to make this text distinctly personal and unique. Secondly, it allows me to introduce aspects of Bakhtin's carnival as a "form of rejuvenation achieved through the playful mocking of the hierarchical order by individuals who find themselves oppressed by it" (DaSilva Iddings, 2007, p. 31).

Carnival keeps schooling in focus as a world turned upside down, but also as a world in which the king is a clown and the fool wears the crown. It is a world of possibilities. It is a world where charivari includes the science of polymers. The circus opens with a colorful charivari where the circus polymer is displayed as a magnificent whole: all the acrobats, jugglers, musicians and clowns, presenting a cacophony of performance. Breaking into monomers, the chapters unite the players in different combinations, sometimes swimming with Jonah and the narwhales, sometimes sliding sensuous Salome onto the back of an elephant, or walking on a tight wire of resolve with Philippe Petit. We dipped into history and juggled Descartes' two balls of thought, leaving both in the air for a return performance. And we imaged Pinocchio and Ishmael, two grand bastions of literature, and erstwhile circus fellows swapping stories in bar.

What has all this play wrought?

While cavorting with elephants in the room, I took the opportunity to examine the work others have done in the curriculum field with respect to science education. While curriculum scholars are busying themselves with gender, identity, place, history, culture, class and race, there is scant literature focusing on the curriculum in science education. Certainly John Weaver (2005, 2010; 2001) has brought some brilliant insight in the

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curriculum of science education, especially when confronting the relationship between technologies, popular culture and the posthuman condition. Theorist, educator Karen Ferneding (2003, 2007) also examines technology, though her focus is in the classrooms. She questions the utopic ideal being pushed by administrators jumping on the bandwagon in the presumed parade towards improved performance. While the push towards improved technologies is frequently linked to the focus on science and math in contemporary education, Ferneding's focus is not on science education, but on arts education and the aesthetics of media technologies. The field of curriculum studies tackles many important areas of education and educational practices, but there are no theorists who are working on the intersections of science and art. So I find there is plenty of room in the ring. And there is certainly a lot to play with.

The Big Juggle



Figure 7: Big Juggle. Copyright Terry Lorant. Reproduced with Permission. Author is eighth from left.

At the Pickle Family Circus, the Big Juggle was always our last act. And so it is here. It is time for educators and learners to come into the ring and play. There is a lot at stake.

So here is where we stand. Science should not be isolated. It should be in the center ring mixing with other disciplines. This was discussed or implied throughout the text, but primarily chapter two. We live in a rapidly changing world where the only thing we can be sure of is change. In chapters three and four, I discussed one path towards realizing this ambitious goal. We can theorize about modes of communication that might help it evolve into relevancy. This includes applying curriculum to mix concepts of the arts into the spaces of science and forging a new amalgam. I consider students thinking,

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recognize their preconceptions, and suggest that we might consider how those ideas might be adapted to a broader understanding of contemporary science.

I suggested in chapter five that we need to take back the community. The process of schooling is presents rigid explanations of how the world works. As educators we must start the conversation about how to *live as if nature mattered*. We need to cultivate a sense of ecological consciousness into our garden. We need to take back the term *community* from business institutions that are only interested in their bottom line. We need to join the circus and let our imaginations fly.

Future work

I plan to continue this work by looking more closely at how other scientists and artists are blurring the boundaries of art and science. I enjoy spending time in the circus and can see myriad ways in which to employ the curriculum. We are fortunate that creative thinkers from all of these fields are finding ways to engage one another. I want to examine these ideas and consider the broader implications for educational reimagining.

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