

## Small Molecules Count Too: Creativity and Change Post–Arab Spring

Over two millennia, and especially between the 8th and 16th centuries, camel caravans and sailboats were vehicles for a thriving decentralized network of trade and transport. This network facilitated massive multi-ethnic and multi-racial circulation of people and information in and out of the geographic area now known as the Arab World. Some have argued [1] that the interconnections within this region and with the world went into a gradual decline after 1498. It was in that year that the Portuguese empire discovered the seaway to India through the Cape of Good Hope.

During this earlier and illustrious time, travelers in and out of Arabian deserts slept through the scorching daylight and traversed the desert at night using the stars for guidance. Seafarers were well versed in navigating the vastness of the seas and the oceans without a compass. They travelled to distant lands by observing celestial bodies and other signs from the wind, sea currents, sea life and the color of the water [2]. These early Arabs also regulated their activities by the lunar calendar, tested their eyesight by spotting AlSuha (Alcor), the elusive star in Ursa Major that ignited the imagination of Arab poets, and proclaimed those among them who could intuit water under bare sunbaked mountains “insightful and discerning.” Nature was the first frame of reference in their experiential living, learning and expression. Thought-by-analogy became reflected in the structure and style of Arabic speech, dialogue and poetry. Seeing patterns, forms and cycles in the basic dynamics of nature helped them grasp, by analogy, other patterns, forms and cycles in the world in which they were immersed.

In the glorious years of the Islamic civilization, especially during the 8th and 9th centuries, knowledge remained synthesized as it evolved through critical assimilation from older civilizations, systematic observation, experimentation and theory building. Indeed, Arab scholars did not recognize boundaries between disciplines of humanities and sciences. One such scholar was Alhazen or Hasan Ibn Al-Haytham, a devout Muslim polymath. While he is most famous for his seven-volume *Book on Optics* (9th century), which later became an inspiration to Leonardo Da Vinci, the genius of the Renaissance [3], AlHazen’s diversified pool of 200 treatises cut across many fields. His writings included titles such as *Analysis and Synthesis*, *The Balance of Wisdom*, *On Seeing the Stars*, *Discourse on Place*, and *Treatise on the Influence of Melodies on the Souls of Animals* [4].

In the 20th century, and especially post–oil discovery, Arab society functioned quite differently than in the earlier period described above. Modernization in the Arab world both escalated material consumption that disconnected people from nature and resulted in importing a compartmentalized educational system from the West. Some critics see this educational system as reductionist—a byproduct of a mechanistic worldview that shaped modern Western society and significantly influenced the rest of the world since the Scientific and Industrial Revolution. Such a mechanistic worldview is said to be rooted in Cartesian analytic thinking (which can lose sight of the fact that the integrated whole is greater than the sum of its parts) and in Newtonian linear causality. This system evidently resulted in a suspect system for evaluating and measuring the standing of students. Even now, in 2013, Arab students who score the highest in high school can enroll in medical school. The second highest scoring students are eligible to study engineering and natural sciences. Low scoring students are placed in Islamic religious and legislative studies (“Shari’ah”) or in art school.

As we move forward into the 21st century, however, a constellation of new concepts, new ways of seeing and interrelating, new practices and newly adopted tools are indicative of a paradigm shift in the works. This transformation is seemingly global and may be taking us from a mechanistic worldview to a systemic, holistic and ecological worldview. A central theme of this new worldview is that of organizing as a network. Also, a central insight to this new worldview is that social systems can emerge and evolve as an expression of a deep order and universal laws that have evolved over 3.7 billion years. Such universal laws may be common in governing complex networks all the way from those networks interconnecting molecules in our cells, to those linking organisms within ecosystems, to the World Wide Web.

In many spheres of life, this transformation in worldview seems to be manifested in a shift in focus from the static to the dynamic, from structures to processes, from the linear to the nonlinear, from analyzing parts to mapping networks, from exclusion of the subjectivity of the observer to integration of that and intuition with the objectivity of the observed. Concurrent with this transformation is a definite shift in education and research, which is a moving away from the single disciplinary emphasis toward an interdisciplinary framework, from a separation of science and humanities and arts to a fusion of all. Fritjof Capra summarized this well:

During the last few decades, the mechanistic Cartesian view of the world has begun to give way to a holistic and ecological view not unlike that expressed in the science and art of Leonardo da Vinci. Instead of seeing the universe as a machine composed of elementary building blocks, scientists have discovered that the material world ultimately is a network of inseparable patterns of relationships, that the planet as a whole is a living self-regulating system [5].

Whereas physics is said to have been the science that shaped the mechanistic worldview in the last century, systems biology is now arguably the science taking the lead in manifesting and fostering a transformation in worldview. For example, the publishing (and aftermath) of the results of the 12-year, \$3 billion Human Genome Project in 2000 by J. Craig Venter and Francis Collins (a complete draft was published in 2003) illustrates key features of this transformation. Commonly known as *The Book of Life*, this project helped trigger the reversal of what was previously observed as a 20th-century reductionist overemphasis on “large” molecules, the genes, as central directing and sole deterministic agencies in our bodies [6,7]. Prior to this publication, biologists had estimated that the human genome would have at least 100,000 genes to account for our perceived higher sophistication vis-à-vis other species. It turned out we have less than 30,000 genes, a finding that helped shift the focus to the complexity within our cellular networks, gained not by more parts (genes), but partially by the novel interconnections and the dynamic interplay of these components within our cells [8]. In the post-genomic era, from 2000 onward, many systems biologists shifted to a new paradigm, one that emphasizes mapping the contextual, the relational, and the dynamic interplay among genes within a fuller range of small and large molecules in the cellular networks of our bodies.

Soon after this publication, millions of dollars began pouring into the research laboratories of a new field—metabolomics. It is a field that complements genomics and the functional sciences of transcriptomics (gene expression) and proteomics (protein expression) in providing a holistic and dynamic view of human biology. Metabolomics is the study of metabolism and metabolic networks through a systemic analysis of a repertoire of small molecules that are involved in or result from metabolism. “The identities, concentrations, and fluxes” of these small-molecule metabolites provide diagnostic snapshots of an organism’s metabolic state [9]. Examples of these molecules are cholesterol and glucose. In the past, a limited number of these molecules could be measured from a sample of body fluids or easily accessible tissues to give some indication to physicians about our health. Metabolomics now promises a more thorough representation of our health status. Soon measurements of hundreds to thousands of these small molecules will be possible. Going forward in this paper, I borrow from metabolomics and from its diagnostic small molecules a metaphor for the social domain.

I also use autopoiesis as a conceptual model going forward in this paper. The term *autopoiesis* was “coined” by Maturana and Varela to name two life-defining features that they identified in all cellular life. The cell is the unit of life. The “selective permeability” of the cell’s membrane to small molecules allows the cell to control and maintain its internal composition. This semi-permeable membrane, or this self-bounded yet open “identity” of the cell, is the first

defining feature of autopoiesis. And within this boundary, the second feature of autopoiesis was explained by these two Chilean systems biologists as a dynamics of self-generation that is manifested when certain molecules, through their interactions, generate recursively the same network of processes that produced them [10]. To rephrase it in Capra's words: "The function of each component in this network is to transform or replace other components, so that the entire network continuously generates itself" [11]. Even though the term *autopoiesis* was invented back in 1972, autopoiesis is increasingly being used in recent years as a conceptual model within social and organizational studies.

In 2000, the Jordanian-born systems biologist Rima Kaddurah-Daouk co-founded the small molecule diagnostic company Metabolon. Since then, one of the authors of *The Book of Life*, Craig Venter, has been on the company's scientific advisory board. Kaddurah-Daouk is a scientist who has a unique synthesized knowledge of molecular biology and biochemistry. Her many achievements include some of the pioneering patent filings in connection with metabolomics. In 2004 Kaddurah-Daouk also co-founded the Metabolomics Society, the "society of small molecules."

I had interviewed Kaddurah-Daouk for my MIT master's thesis on technology-based economic development [12]. At that time I was under the influence of a gene-centric top-down approach to business and economic development planning as outlined by Timmons and Bygrave in their book *Venture Capital at the Crossroads* [13]. My thesis argued that the genetic code of a thriving high-tech region can be replicated in other regions. Within this context I, in effect, represented Kaddurah-Daouk as a "gene expression" of MIT and Route 128, a region with an enabling structure and a "code" that made it possible for Kaddurah-Daouk to spin off a biotech company, Amira (Arabic for "princess"), out of her own inventions at an MIT lab. I had no way back then of seeing the more important poetic and aesthetic symbols that her science could trigger going forward for me.

There are parallels between the diagnostic possibilities enabled by small molecules and the creative expression of highly conscious human beings. Creative expressive acts of such individuals emerge out of continual dialectical and intense encounters with their world. The world of a creative individual, as the American existential psychologist Rollo May notes in his book *The Courage to Create* [14], is the pattern of all meaningful relationships that one influences and is influenced by. May explains that, in the creative acts of such people, the self comes to imply such an interrelated world, and such a world comes to imply the self.

Like artists, small molecules are a symbolic language that paints a picture of what has happened and is happening to living systems, taking into account not only genetics but also cellular networks inside our bodies, lifestyle and the environment. By a reasonable stretch of imagination, the definition of "artist" in this context can and needs to be expanded to include those conscious creators with expressive initiatives, acts and creations that include visions, aesthetics and collective good beyond what is merely successful in their world. The implied analogy between the conscious, creative self and a small molecule in those diagnostic parallels was brought to life during the Arab Spring.

The Arab Spring was triggered on 17 December 2010 by a story, with an image, of a young Tunisian man, Bouazizi, setting himself on fire. It was a burning expression of protest against the confiscation of a livelihood—his peddling cart—and against his consequent humiliation by the authorities. Bouazizi's story had resonance because it exemplified a recurring pattern of a man like all men and women suffering economic unfairness and injustice. It touched people across the Arab World at a very basic level of sense, sensibility and universal meaning.

Digital media allowed Bouazizi's story to unfold into an expression of an ailing interconnected collective, as people took to the streets. It lent infinite entry points for people to express and to report consequent contextual actions and coordination of riots and protests. The Satellite News TV Al-Jazeera, which was for years not allowed in Tunisia, amplified the impact of social media. Al-Jazeera interrupted its scheduled programs and dedicated airtime for re-broadcasting up-to-the-minute camera phone footage that was being uploaded to YouTube and Facebook by young Tunisians. Al-Jazeera continued stitching together that social media footage and related text, tweeted or blogged, and delivered it amplified to every living room of ordinary Arabs.

In this across-multiple-platform, or transmedia, storytelling, every contribution of content online and offline by conscious young people was causally linked to content that influenced it or is influenced by it. In this autopoietic recursive information flow, and within a complex web of feedback loops, distinction between author and reader, and between actor and spectator, blurred in an evolving epic of a leaderless revolution.

The success of this manifested “collective intelligence” in Tunisia, the smallest Arab state in North Africa, in bringing down the centralized power of a tyrant within days after Boauzizi’s self-immolation instantly sent a “yes-we-can” message to the largest Arab State—Egypt. From Tunisia onward, the Arab Spring continued to echo the existential lyrics of the German sociologist Niklas Luhman: “To be or not to be is to continue to communicate autopoietically or not” [15]. The transformation of every conscious individual within a self-organizing collective whole into a “storytelling hero,” a narrating poet and/or an “audio-visual pop artist” elucidates the aesthetics of autopoietic communication.

Autopoietic communication now needs to go beyond dismantling a top-down power structure that does not work. It needs to promote platforms for scalable autopoietic participation of “all molecules” in sustainable creation processes. More specifically, the exchange needs to entice participation by everyone in the imperative circular causality of human creativity and creation. It needs to promote self-expression of an individual as a collage of creations of all others who are either helped or were helped by one’s own creation. As Pablo Neruda wrote in his *Memoirs* in 2001:

Perhaps I didn’t live just in myself, perhaps I lived the lives of others. From what I have left in writing on these pages there will always fall—as in the autumn grove or during the harvesting of the vineyards—yellow leaves on their way to death, and grapes that will find new life in the sacred wine. My life is a life put together from all those lives: the lives of the poet [16].

Neruda’s words tell us that, if a poet is capable of touching another person with an inspiration to create, this poet will have been renewed and reborn again. Drawing meaning for our lives from our ability to find our voice in what we create and in our ability to empower another person, at least through inspiration, and preferably through more modes of support, is how a social system ensures sustainable renewal and growth.

All of the above raises a pressing existential question that may very well have bearings on the emergent potential of the collective. What can entice people to participate in repeatable cycles of creation such as those animated by Neruda’s words? What makes us see more inclusive dimensions for identifying, empathizing and aligning ourselves with creative others beyond what is immediately/obviously universal in meaning and what gives us the free will, courage, creative ethos and generosity to act on it?

In the Arab World, impermeable boundaries are not always visible. We see them in the “new Berlin Wall,” in its solidified seas of cement and in its erected military checkpoints around Jerusalem. However, impermeable boundaries of identities defined by family, clan, class, religion and/or ethnicity can be much less visible but more dangerously rendered in the way of limited access to the resources and funding that fuel creativity and creation to those within or outside such impermeable boundaries. These inherited boundaries of identity should not necessarily be obliterated. But without the courage to negotiate them, we cannot leap into the unknown to explore new terrains. And without the free will to construct new selves through a multitude of choices and the creativity to reconstruct and expand such boundaries by virtue of interrelatedness with others, fidelity to such boundaries becomes conformism to some and exclusion to others. Moreover, connecting with nature and pluralistic learning experiences are likely to reduce casualties in the form of fragmented selves from a compartmentalized educational system.

The above narrative about boundaries and identity may be rephrased as a question of balance between the autonomy of the individual and a sense of belonging to a self-bounded collective. Such rephrasing resonates with a question raised by Edward Said, the late Palestinian American and Columbia University scholar, in his book *Reflections on Exile and Other Essays* [17]. Said presents the question in the context of what he thought was “left unanswered by John Berger’s work” titled *Another Way of Telling* [18]. Said’s question is: “Can one really undertake aesthetics in the private sector, so to speak, and launch it out from there directly into politics?”

Artists in the two examples below elucidate possibilities. One artist, Avi Moghrabi, produced provocative documentaries that speak to the injustice inflicted by his Israeli community on the Other—the Palestinians. The other, Elie Suleiman, a pioneering Palestinian filmmaker, took the unprecedented controversial action of withdrawing from a Palestinian cultural boycott in protest of the mistreatment of a fellow insurgent Israeli filmmaker during a film screening in Cairo. Those insurgent “small molecules,” or artists beyond borders, were able to reconcile bonding with their own warring communities with the free will to live by self-selected creative and moral ethos.

The need to balance a sense of autonomy for the self with a sense of the collective was also beautifully manifested by Ken Rinaldo in his award-winning interactive robotics installation titled *Autopoiesis 2000* [19]. In this work the state of each of the 15 robotic sound sculptures is determined by its own internal organization. This state is also determined by the structural interrelatedness of each robotic sound sculpture with the other robotic sound sculptures, and by the audience.

Another example comes from my own life. In early 2000, I created the first venture capital fund for investing in the Arab Internet at a time when there were less than 2 million Internet users in the Arab World. By early 2013 this number has reached approximately 100 million. A recent study by Booz & Company and Google shows that the most digitally active from among these Arab Internet users are aged 15–35. Also, the unemployment rate among these young people is incommensurate with their attained education. According to this study, about 43% of these young people wish to create their own entrepreneurial initiatives [20]. Specifically within this group there are higher expectations for socioeconomic change, immediacy and aesthetics of narration over video in the post-Arab Spring environment. The scale and the nature of the challenges described above render the existing gatekeeping paradigms of funding limited in their ability to support creativity and to make an impact in the Arab World. Online platforms that aim to build on the scalability of social media to crowdsource support from the public for cycles of creation are now much needed in the Arab world and are starting to surface. The evolution and scalability of such platforms will hinge on many supporters perceiving the act of helping others create as strongly resonating with their identifying values, creative ethos and/or religious spiritual practice. Presenting such creations for public viewing and storytelling, most notably over video, will inspire others to create. This creates autopoietic feedback loops whereby each person’s creative expression is influenced by what has come before and then goes on to influence and inspire later work by others.

By creating, and/or by acting on an appreciation of other peoples’ creative acts, many lives will be transformed to what I coin as the life of an “entrepoet”: A life “put together” from continuous cycles of creation—from 1,001 tales of creating and narrating so that the flame of creativity never dies. Or to borrow from Pablo Neruda: The life of an entrepoet is a life “put together from all those lives”—lives of yet more “entrepoets” who may emerge to gracefully manifest life’s cycles of self-creation and self-renewal that the autopoietic holistic lens depicts.

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### References and Notes

*Unedited references as provided by the author.*

1. Antoine Zahlan, “Technology: A Disintegrative Factor in the Arab World,” in *Middle East Dilemma: The Politics and Economics of Arab Integration*, Michael C. Hudson (Editor) in association with the Centre for the Contemporary Arab Studies, Georgetown (New York: Columbia University Press, 1999) pp. 259–278.
2. George F. Hourani, *Seafaring in the Indian Ocean in Ancient Times and Early Medieval Times* (New Jersey, Princeton University Press, 1995) p. 106.

3. Fritjof Capra, *The Science of Leonardo: Inside the Mind of the Great Genius of the Renaissance* (New York: Anchor, 2007).
4. See Wikipedia article on Alhazen for more information about his life and a bibliography, <<http://en.wikipedia.org/wiki/Alhazen>>.
5. Capra [3] pp. 264–265.
6. Fritjof Capra, *The Hidden Connections: Integrating the Biological, Cognitive, and Social Dimensions of Life into a Science of Sustainability* (Doubleday, 2002).
7. Stuart Kauffman, *At Home in the Universe: The Search for the Laws of Self-Organization and Complexity* (New York: Oxford University Press, 1996) p. 274.
8. Albert-Laszlo-Barabasi, *Linked: How Everything Is Connected to Everything Else and What It Means for Business, Science, and Everyday Life* (Plume, 2003) pp. 179–183, 196–197.
9. Rima Kaddurah-Daouk, Bruce S. Kristal, Richard M. Weinshilboum, “Metabolomics: A global biochemical approach to drug response and disease,” *Annual Review of Pharmacology and Toxicology* 2008; 48: pp. 653–658.
10. Humberto Maturana, “Autopoiesis, Structural Coupling and Cognition: A history of these and other notions in the biology of cognition,” *Cybernetics & Human Knowing*, Volume 9, Numbers 3–4, pp. 6–9 (2002).
11. Capra [6] pp. 9–10.
12. Amal Alayan, *Strategies for Technology-Based Economic Development, Master's thesis* (MIT, Cambridge, Massachusetts, 1993) pp. 75–104.
13. William D. Bygrave and Jeffrey A. Timmons, *Venture Capital at the Crossroads* (Cambridge, Massachusetts: Harvard Business School Press, 1992) pp. 251–260.
14. Rollo May, *The Courage to Create* (New York: W.W. Norton & Company, 1994) p. 50.
15. Niklas Luhmann, “Autopoiesis of Social Systems,” in his *Essays on Self-Reference* (New York: Columbia University Press, 1990) pp. 1–21.
16. Pablo Neruda, *Memoirs* (New York: Farrar, Straus and Giroux, 2001) p. 4.
17. Edward Said, *Reflections on Exile and Other Essays* (Cambridge, Massachusetts: Harvard University Press, 2002) p. 152.
18. John Berger, *Another Way of Telling* (Random House, 1995).
19. Ken Rinaldo, *Autopoiesis, Interactive Robotic Sculptures*, see <[www.youtube.com/watch?v=qLYvF83Qrrc](http://www.youtube.com/watch?v=qLYvF83Qrrc)>.
20. K. Sabbagh et al., “Understanding the Arab Digital Generation,” The Ideation Center, Booz & Company (2012).