

Educators as Architects of Living Systems: Designing Vibrant Learning Experiences beyond Sustainability and Systems Thinking

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Abstract

This article discusses how living systems principles can inform educational design. It describes a theoretical framework for creating academic learning experiences as organic wholes that sustain learning verve. The framework is intended to aid educators in awakening a felt sensation of aliveness, vibrancy, and self-organizing creativity in a group of learners. It seeks to create congruence between learning content and teaching methodology in ways that nurture a felt sensation of engagement and ways that sustain participants as change-makers for a healthier, more sustainable world. The research presented in this paper draws from living systems theory, ecology, ecopsychology, as well as transformative learning theory and related schools of thought. Special attention is given to the “autopoietic” processes of learning experiences as living systems which are self-organizing, dynamic wholes rich in relational patterns that carry the potential for generative insight, emergent knowing, and palpable empowerment of learners. The theoretical framework utilizes metapatterns of nature to create a versatile design structure for mimicking the dynamics of living systems across multiple ways of teaching and learning. The paper concludes with a series of design questions intended to assist educators in testing this new framework in sustainability courses, workshops, and conferences.

Key Words: sustainability education; living systems; transformative learning; multiple ways of knowing; ecological literacy; autopoiesis.

Imagine a learning community as a wetland or a forest. Imagine a group of learners as an organic, highly interdependent community, a living system not unlike an ecosystem in nature. Listen to the hustling and bustling of all its life forms; feel the pulsation of this living organism as a whole. Now remember participating in a learning experience that felt particularly vibrant, an experience that had a palpable sensation of aliveness. Remember a time where the group of learners seemed to embody an organic whole, an ecosystem with a life of its own, pulsating with energy and creating something new and exciting, something no single participant could have foreseen or created on his or her own.

Introduction: Expanding the Horizons of Sustainability Education

I felt compelled to write this article after attending the Bioneers Pre-Conference Workshop *Education for Action in the Age of Climate Change* in October 2009. During a whole day of panel presentations, dialogue, and engagement with some of the leading sustainability pioneers in the country, participants called for revolutionizing higher education to develop capacities for educating sustainability change makers. Panelists agreed that this revolution must involve learning how to think systemically, multi-disciplinary learning opportunities, and engaging students through real-life projects in local communities. While I am excited about the growing academic commitment toward education for a healthier, more sustainable world, I am suggesting that we are not radical enough in our call for a revolution in sustainability education: Addressing the local, regional, and global challenges we face will require levels of knowing, creativity, and care much deeper, wider, and more complex than called for during the Bioneers convention.

Let me begin with an example as an entry point into this discussion: At the Bioneers pre-conference, during a five-minute closing circle (after a whole day of largely cognitive-rational dialogue) participants' emotions were invited in by sharing one feeling we are leaving with. That is less than 1% of our time together devoted to the heart. This was a highly valuable workshop, yet I am proposing to radically expand the boundaries of relating in a context where participants share so much anguish around the state of the world. Talking and engaging in project-based learning is not enough if our hearts are breaking, shrinking, dissociating, or building protective walls around them at the same time. Ecophilosopher and systems scholar Macy states "What we have been taught to dismiss as mere feelings are responses to our world no less valid than rational constructs. Sensations, emotions, intuitions, concepts, all condition each other, each a way of apprehending the relationships which weave our world" (Macy & Brown, 1998, p. 43). If we apply McDonough's favorite sustainability definition "loving all children of all species of all times" (McDonough, 2010) to the context of sustainability education, what shift might we invite? I strongly believe that this shift requires expanding our boundaries of perception and capacities of relating into dimensions that include but go beyond systems thinking and practical doing. It requires developing capacities for co-designing felt, vibrant learning experiences that mimic the living systems of nature and nurture capacities for radical care for self, other, and the world.

Drawing on the growing academic discourse in transformative learning (Daloz, 2004; Dirkx, 1997; Ferrer, 2005; Heron, 1992; Lange, 2009; Yorks & Kasl, 2006), living systems theory (Booth-Sweeney, 2008; Capra, 1996), metapattern theory and its applications in education (Volk & Bloom, 2007), ecospsychology (Fisher, 2002), and indigenous ritual design (Somé,

1999), and my experience participating in multiple sustainability-related workshops, I am proposing an expanded pedagogical framework for sustainability educators. The framework applies nature's living systems principles (Capra, 1996) and metapatterns of nature (Volk & Bloom, 2007) to preparing and facilitating learning experiences in higher education (such as courses, workshops, or conferences). It is intended to assist educators in a multi-dimensional design process beyond learning how to think or even learning how to think systemically, and beyond learning by doing, toward learning how to relate, co-create, and co-evolve as a caring living, learning community.

It is my hope that further discourse and experimentation will be inspired as a result of the ideas presented here¹.

Principles of Living Systems as a Foundation for an Expanded Framework

In academic teaching, workshops, and conferences for sustainability and transformative change, I have frequently experienced inconsistencies between learning content, structure, process, and environment. If the medium does not mirror the message, learning falls short of its potential. There is a disconnect if the learning modality embodies a traditional hierarchical structure (lecture, conference presentation, panel with questions and answer) while the content explores decentralized, pluralistic, highly interdependent dynamics². There is a disconnect if the learning or conference modality is limited to a cognitive-rational mode of relating dominated by verbal dialogue while students or attendees are called to participate in the daunting and emotionally overwhelming task to protect life on Earth.

Nature's patterns and processes of relating and co-creating the conditions conducive to life provide the foundation for the sustainability education framework advocated here. These patterns and processes have been studied and summarized by living systems scholars. Booth-Sweeney (2008) defines living systems as follows:

We use the phrase *living systems* as a metaphor, to represent an animate arrangement of parts and processes that continually affect one another over time. There are living systems on all scales, from the smallest plankton to the human body to the planet as a whole. When we understand what makes up a living system, we can see that a family, a business, and even a country also are living systems. (p. 3)

All living systems follow the same basic organizing principles and patterns of relating. Macy states: "They [scientists] found that these principles or system properties to be awesomely elegant in their simplicity and constancy throughout the observable universe, from suborganic to biological and ecological systems and mental and social systems, as well (Macy & Brown, 1998, p. 41)." I maintain that becoming literate in these organizing principles, becoming "ecoliterate," must form the foundation of any sustainability education endeavor. Ecoliteracy goes beyond grasping the significance of these organizing principles with the mind, however. It involves experiencing these principles with our hearts and souls, as well, because as agents in a rapidly



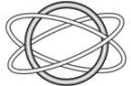



¹ More details are discussed in my dissertation research (Widhalm, 2010).

² I applaud the organizers of the Bioneers pre-conference workshop for taking the risk to devote two hours of the day to open-space dialogue.

changing and unpredictable world, we require all the adaptability, emotional intelligence, and co-creativity we can muster. The recent catastrophe in Japan illuminates this challenge: As effective sustainability change agents we need a whole-person, affective, compassionate awareness of the world as an interconnected and interdependent living system.

Table 1 lists the principles of living systems as defined by systems scientist Fritjof Capra (Center for Ecoliteracy, 2004). Each of these principles describes an ecological function. To this function I add a felt quality of relating. I suggest that awakening this felt quality in learners reinforces a deeper understanding of living systems dynamics³.

Table 1: Living Systems Principles⁴

Systems Principle	Definition	Felt Sensation and State of Awareness
 <p>Nested Systems</p>	<p>“Throughout nature we find multi-leveled structures of systems nesting within systems. Each of these forms an integrated whole within a boundary while at the same time being a part of a larger whole.”</p>	<p>Belonging; feeling part of a larger whole; feeling co-responsible for that which is smaller and larger than us.</p>
 <p>Network</p>	<p>“All members of an ecological community are interconnected in a vast and intricate network of relationships, the web of life. They derive their essential properties and, in fact, their very existence from these relationships.”</p>	<p>Connecting across difference; learning through diversity; feeling part of the web of life.</p>
 <p>Dynamic Balance</p>	<p>“All ecological cycles act as feedback loops, so that the ecological community regulates and organizes itself, maintaining a state of dynamic balance characterized by continual fluctuations.”</p>	<p>Feeling seen & heard; compassion; empathy; honesty; transparency.</p>
 <p>Cycles</p>	<p>“The interactions among the members of an ecological community involve the exchange of energy and resources in continual cycles. The cycles in an ecosystem intersect with larger cycles in the bioregion and in the planetary biosphere.”</p>	<p>Feeling attuned to the cycles and seasons of life: active (expressing – creating), resting (reflecting – integrating).</p>
 <p>Flows</p>	<p>“All organisms are open systems, which means that they need to feed on a continual flow of energy and resources to stay alive. The constant flow of solar energy sustains life and drives all ecological cycles.”</p>	<p>Feeling open to change and being changed, open to new influences and ideas, and to letting go what is no longer needed.</p>
 <p>Development</p>	<p>“The unfolding of life, manifesting as development and learning at the individual level and as evolution at the species level, involves an interplay of creativity and mutual adaptation in which organisms and environment co-evolve.”</p>	<p>Feeling open to new developments unfolding; appreciating that which was not there before: awe; curiosity, wonder.</p>

³ In my dissertation I give examples of how each principle manifests in ecological as well as social/educational systems, and how each principle can be applied in the design of learning experiences across multiple ways of knowing (Widhalm, 2010).

⁴ These illustrations and definitions were taken from the Center for Ecoliteracy website in 2004. An expanded version of principles, without the illustrations, is available in Stone & Barlow (2005).

Most importantly, Capra (2009) determined that the characteristics of living systems in nature are all expressions of relational patterns in community. Nature continuously changes, unfolds, and develops through its dynamic relational patterns, structures, and processes. Contact and communication among system components and larger systems are at the heart of life's continual unfolding, and are essential to any living system's capacity to renew itself and develop new complexities, a capacity known as autopoiesis.

The concept of autopoiesis (originally coined by Maturana and Varela, 1991) holds tremendous application potential in the sustainability education context. Capra (1996) defines the following properties of an autopoietic network, Such a network is

- Self-bounded: The boundary is an integral part of the network. The system is organizationally closed but open with regard to flow of energy and matter.
- Self-generating, self-renewing, and self-perpetuating: All components are continually produced and replaced by transformation processes within the network.
- Structural coupling: New structures are created through interaction with the environment, which results in continual adaptation, learning, and development.

The three characteristics of autopoiesis, being self bounded, self-renewing, and structural coupling, are critical in the context of designing learning experiences for sustainability. According to these three characteristics, a course, workshop, or conference that is alive similar to an ecosystem will develop strong but permeable boundaries, build intricate networking capacities among its participants in order to foster mutual growth and development, and will allow for a continuous exchange with its environment for cross-pollination and development of new insights. Living systems are learning systems (Capra, 2009). Autopoiesis, regardless of its literal translation as a self-making process, is, in its very essence, an each-other-making and us-making process.

Applying the organizing principles of living systems to social systems is not a novel idea. The paradigmatic shift toward a systems worldview has been in the making for over half a century (Capra, 1996). Much has been written about how this worldview is slowly beginning to transform different areas of our lives, including technology via Biomimicry (Benyus, 2002), and systems-based eco-industrial design (Pauli, 2010), agriculture (Pauli, 2010), and Permaculture (Mollison, 1997), ecological design (McDonough & Braungart, 2002), organizational development (Senge, 2006), and grassroots activism (Macy & Brown, 1998). In higher education, the value of grounding curriculum in a systems worldview has been discussed on a theoretical level (Doll, et al, 2005; Reynolds & Craven, 2009; Sterling, 2007) but so far there has been little discourse on practical applications.

Approaching learning communities as living systems represents a shift away from viewing education as something that can be compartmentalized, planned and pre-designed, measured, and quantitatively assessed with learning outcomes and grades (Doll, et al, 2005). This shift makes space for ways of knowing and learning that are co-created by the educator, learners, and many external factors and underlying design structures influencing the learning process.

Key Aspects to Awakening Learning Experiences as Vibrant Living Systems

Drawing from multiple disciplines, I will now discuss several important aspects to learning experience design: accessing direct experience through multiple ways of knowing; recognizing living systems as loving systems; recognizing living systems as soulful systems; and seeing living systems design as ritual design.

Accessing Direct Experience through Multiple Ways of Knowing

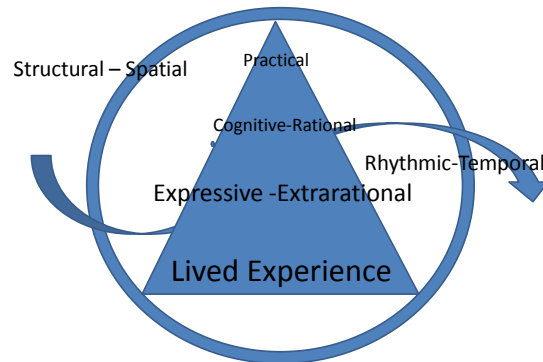
Foundational to the framework for sustainability education proposed here is the need to ground learners in the direct experience of life that sustains us all (Heron, 1992). The experiential way of knowing as defined by transformative learning scholar Heron is the foundation that underlies all other ways of knowing which Heron organized in a pyramid, with each prior level providing a foundation for the next: the experiential at the base, followed by the presentational-expressive, propositional-analytical, and practical-skill-based at the top. This pyramid is integrated with modified terminology in Figure 1 below. The experiential realm can be tapped into via the presentational-expressive realm of knowing, which includes any form of creative expression, such as visual or performing arts, story telling, and movement (Yorks & Kasl, 2006). Expressive ways of knowing help learners become grounded in direct experience as the very foundation of knowing and can bring this felt quality of *being* into cognitive-rational and practical realms.

Integrating Heron's (1992) pyramid with ecological design and group facilitation techniques, I am offering a simplified model explaining multiple dimensions of learning experience design (see Figure 1 below): Lived experience (referring to the experiential realm in Heron's model) lies at the very foundation of knowing, informing, through expressive, extra-rational "osmosis," the cognitive-rational and practical dimensions of knowing. In addition, the structural-spatial dimension describes all the visible and invisible space considerations of a learning experience, including the room setup and constellations of physical and virtual individual and group learning spaces with various degrees of planned and open-ended structure. The rhythmic-temporal dimension pertains to the timing and pacing of a learning experience, including time allocated for active as well as slower, integrating times.

Each of these dimensions deserves consideration in learning experience design, be it a conference, workshop, or course. Heron's pyramid is used in the center in Figure 1 to illustrate the importance of grounding learning in lived experience and giving significant weight to the expressive, extra-rational realm of learning experience design. By tapping into lived experience via expressive, extra-rational ways of knowing, the quality of cognitive-rational and practical learning is greatly enhanced. The rhythmic-temporal and structural-spatial dimensions are important to take into consideration when emulating the structures, patterns, and rhythms of a living system. I maintain that if a learning experience mimics the structures and rhythms of a living system, the experience invariably begins to feel more alive and vibrant. Among the dimensions of learning experience design included in this model, cognitive-rational learning remains academia's stronghold and is, to some degree, complemented by practical knowing in sustainability education (such as project-based learning and service learning). I suggest that cognitive-rational and practical ways of knowing are only the tip of a more holistic learning pyramid. In order to prepare sustainability change-agents in an increasingly unpredictable and emotionally challenging world, sustainability educators must begin to integrate these other

dimensions, as well. I offer guiding questions at the end of this article to inspire this more holistic way of instructional design.

Figure 1: Dimensions of Learning Experience Design



I offer an interdisciplinary discourse below to further highlight the inner, felt dimensions of living systems this model seeks to illuminate: 1) living systems as loving systems, 2) living systems as soulful systems, and 3) living systems design as ritual design.

1) Living Systems as Loving Systems: Contact, Relational Learning, and Identity

“Survival of the fittest” (Darwin, 1911) is no longer considered a driver for evolution among leading scientists. The key characteristics of autopoiesis (self-bounded, self-renewing, and structural coupling) manifest through relationship and contact among system components and among systems. Ecopsychologist Fisher (2002) defines contact as “an activity of ex-change, transaction, meeting, fusion-across-difference, transmission, encounter, or engagement with the world – without which no life or experiencing would be possible” (p. 65). Fisher states: “Reality is most fully given or revealed under ongoing conditions of good, organismically satisfying contact: while we suffer a diminished and decaying reality under conditions of weakened or distorted contact” (pp. 65-66). What would “organismically satisfying contact” look like in the context of higher education?

Leading scientists and sustainability scholars increasingly speak to the importance of heartfelt relating. Hawken (2007) states: “To salve the world’s wounds demands a response from the heart” (p. 188). Uhl affirms this: “In the end, it is not new laws or more efficient solar cells that will play the leading role in solving humankind’s environmental and social problems, it is our awakened and caring hearts. When our hearts awaken, our resolve quickens, our courage grows, our compassion stirs, and our imagination expands” (Uhl, 2004. p. xx).

Transformative learning and education scholars (Dirkx, 1997; Lange, 2009; Thayer-Bacon, 2003; Yorks & Kasl, 2006) identified relational learning and care as critical to any transformative pedagogy. Sustainability educator Sterling (2007) emphasizes a relational pedagogy that includes the “other” and empathic connection as a necessary foundation for “education as sustainability.”

The educational framework put forth here is in strong agreement with the above referenced statements. All healthy living systems are, at their very essence, loving systems. In

fact, life on earth as manifested in ecosystems and communities can be viewed as a deep expression of caring. Buhner (2002) highlights the tremendous capacity of all life forms to communicate and cooperate: from sacrificial plants dying so that the others may live, to different species warning each other about predators approaching, to plants sending healing chemicals through their roots when there is illness nearby – not just within the same species, but between species. It is this level of deep care, of “organismically satisfying contact,” that makes a living learning system come alive, as well.

Non-formal education programs have recognized the critical importance of creating opportunities for heartfelt connections for change-makers. Examples include the *Awakening the Dreamer* Symposia (Pachamama Alliance, 2010), and *The Work that Reconnects* (Macy & Brown, 1998; Macy, 2006). Universities, as hotbeds for innovation and places where future decision-makers are prepared must also serve as models for mutual care and relational learning.

The ancient Tibetan Shambala Prophecy says that the two weapons of the Shambala warrior to fight against the destruction of the earth and to dismantle weapons in the “corridors of power where decisions are made,” are compassion and insight into the radical interconnectedness of all beings (Macy & Brown, 1998, p. 61). This prophecy illuminates the connection between living and loving systems. The “weapons” of compassion and radical interconnectedness of all beings are weapons of love and insight to life as a web of radically interconnected living systems. Universities, the institutions that prepare our future decision makers, must nurture both.

Where is sustainability education in relation to teaching compassion and the radical interconnectedness of all beings? Thus far, criteria of love and compassion, and of radically interconnected living systems, are largely missing from sustainability education rating systems (AASHE 2010), which indicates that they are not yet sufficiently valued as significant factors in sustainability education. A major revision would be needed to measure the very foundations that sustain the world and its beings as a loving, radically interconnected web of life.

In this context, the concept of identity is critical to embrace for educators who are committed to preparing change-makers with capacities of self-confidence and adaptability. Here I consider identity as a function of relationship and radical interdependence. Identity is developed and continuously strengthened as a result of being seen, beheld, and loved (Toro, 2002). Similarly, indigenous cultures around the world embrace identity formation as a highly relational process. Kumar (2002) developed a Declaration of Dependence based on the old Sanskrit dictum of *So Hum* which can be translated as ‘You are, therefore I am.’ The African concept of *Umbutu* (Umbutu, 2010) speaks to a sense of identity derived from belonging to community as a larger whole.

Western concepts of identity tend to focus more on comparison and competition. However, in a sustainable society, I believe we need to re-learn identity formation as a process of radical interdependence. To foster this notion of identity, the roles of the educator as well as of co-participants in a learning environment are to take utmost care in seeing the other through heartfelt verbal and nonverbal feedback.

2) Living Systems as Soulful Systems

Soul in the context of my model for sustainability education describes the very essence of feeling alive, the inner, felt quality of a living system. “Being awestruck by a brilliant sunset, captured by the majestic beauty of a rising full moon, or gripped by the immense pain and helplessness we feel for a child trapped deep inside an abandoned well are experiences of soul”

(Dirkx, 1997, p. 80). Transformative learning scholar Dirkx describes soul as an experience, a state of *being*, which is akin to Heron's (1992) experiential, foundational realm of knowing.

In learning experiences, soul qualities can be accessed through metaphoric, imaginal, narrative, ritualistic, and contemplative ways of knowing (Dirkx, 1997; Leonard & Willis, 2008), all of which correspond to the expressive, extra-rational realm of knowing described above. Dirkx (1997) emphasizes that forms of learning that are "marked by high levels of uncertainty, ambiguity, contradiction, and paradox, invite expressions of soul" (p.82), but that "rigid adherence to an agenda or curriculum mitigates against expression of soul...Denial of soul within the learning environment is denial of a life force and makes itself felt through an absence of energy, enthusiasm, and vigor" (p. 85). The reader is probably very familiar with such a "denial of soul" in learning, be it in a course, workshop, or conference. Educators who develop capacities to evoke and hold spaces of uncertainty help a learning experience *feel* alive as an adaptive, continually changing living system.

What then would soulful learning look like? "The wholeness of learners' lives – not just their heads – are brought into the circle, and the group itself comes into being as an entity" (Dirkx, 1997, p. 82). This "coming into being as an entity" is a coming into being as a vibrant living system that unfolds through a dynamic dance of careful structuring and letting go.

Lange (2009) illuminates this dynamic by describing how she creates learning sanctuaries in sustainability education: holding the space open to learning that occurs beneath any pedagogical plans; bringing people into relationship with the natural world through direct encounters; and nurturing deeply committed relationships participants develop with each other and with facilitators. The importance of creating and holding space will be explored further in the following section.

3) Living Systems Design through Ritual

Creating sacred space and ritual holds deep transformative value in higher education (Daloz, 2004; Dirkx, 1997; Lange, 2009). There are strong synchronicities between living systems principles and the design components of ritual. I suggest that learning experiences for sustainability change-makers follow a sequence of carefully designed stages not unlike the stages of a ritual, to allow for transformative, autopoietic developments. African scholar Somé (1999) describes ritual as follows:

Every time a gathering of people, under the protection of Spirit, triggers a body of emotional energy aimed at bringing them very tightly together, a ritual of one type or another is in effect. In this kind of gathering people primarily use nonverbal means of interacting with one another, thereby stimulating the life of the psyche. (p. 142)

Ritual is a very carefully designed process that consists, according to Somé, of a planned and unplanned portion. It is a "time of unplanned, unforeseeable, yet orderly disorder" (p. 142). Similarly, from a living systems perspective, autopoiesis happens when the predictable meets the unpredictable, and the designed-for structures are inspired by the undesignable.

In the context of learning experience design for sustainability education, it is useful to summarize how Somé (1999) describes the general sequence of stages in a ritual:

1. Preparing the space (utilizing beautiful symbols and decorations that invite mystery);
2. An invocation (such as calling in the four directions, spirits, ancestors, with a specific request for assistance);

3. A participatory healing process in which participants witness and support those who are going through a transformative activity (such as a dance, or a vision quest in nature), and bring them back into the circle;
4. A closing ceremony expressing gratitude and releasing the spirits.
Somé describes a process of carefully preparing and closing the space in a safe container of community, and then letting “orderly disorder” take over (p. 142).

Metapatterns as Guides to Living Systems Educational Design

Thus far I have described key components informing the design of learning experiences as living systems: Capra’s principles of living systems and the process of autopoiesis, dimensions of learning experience design, stages of ritual, and the importance of heartfelt and soulful relating. I will now bring these aspects together by introducing the concept of metapatterns of nature. The theoretical significance of metapatterns has been discussed by Volk & Bloom (2007) and was originally inspired by Bateson (1991), who coined the term “patterns that connect.”

Metapatterns are broad, overarching patterns that span multiple contexts (e.g., academic disciplines, cultures, personal experiences, etc.), and are transphenomenal and transdisciplinaryAlthough context-specific meanings of each metapattern may differ, the essential core meanings or functions are shared across such contexts (Volk & Bloom, 2007, p. 46).

Volk & Bloom (2007) elaborate, saying that “metapatterns provide a framework for exposing interactions among patterns of cognition, discourse, culture, organization, physical and social environments, and other contexts” (p. 49). They maintain that “metapatterns can serve in the process of learning as templates for understanding systems on a number of different scales, and thus for making connections between these scales” (p. 37).

Below, I utilize metapatterns to translate metaphorical images of nature (membrane and patterns that connect organically) to educational design approaches. I then introduce guiding questions, as well as examples and implementation ideas for applying these metapatterns to multiple aspects of learning experience design⁵. My intention is to help educators integrate living systems awareness into all aspects of designing learning experiences, so that learners become more conscious of being a co-creative agent in any living system they are part of, which in turn helps them develop capacities as vibrant, adaptive change-makers in difficult times.

Membrane

A membrane is a semi-permeable boundary that gives a living system a distinct place to be and evolve. It controls what kind of energies and nutrients migrate across the boundary. Cell biologist Lipton (2008) considers the membrane a critical aspect of genetic development and evolution, more significant than DNA.

⁵ In my dissertation, I further analyze patterns that connect by mapping Capra’s principles or “metapatterns” of living systems across multiple dimensions of learning experience design (Widhalm, 2010).

In social systems, a membrane creates a sense of identity and belonging to a whole distinct from, yet interconnected with, other wholes. The membrane is a container that can only exist in community. It needs witnesses, peers, and places in which learners have the opportunity to be seen and to see. Creating a sense of membrane goes beyond dedicating space and time to meet as a group, however. Every conference starting and ending with a series of speeches and neglecting the opportunity to invoke a participatory ritual of belonging, for example, leaves its membrane potential un-activated.

Patterns that Connect Organically

Within the membrane, system components engage in different patterns of relating. In any living system, continuous flows of information, energy, and nutrients are exchanged in a dynamic balance of giving and receiving through multiple feedback loops. They form a complex network of relationships, from the cellular to the global level. In nature, some of the patterns that connect can be seen, such as meanders in streams, ripples in a lake, branching patterns in trees, network patterns of a spider web, spirals in snail shells, or honeycomb patterns. Underneath are also countless intricate unseen patterns of relating, patterns of energy and information, and chemical exchanges on molecular and cellular levels. These movements are not controlled by a single entity, they continually self-organize. Patterns that connect are always in motion, in flux, and changing. Creating patterns that connect in educational settings, therefore, goes beyond providing for simple alternations of large group and small group experiences. It also goes beyond keynote sessions linked with topic workshops. I give examples of more dynamic and self-organizing pattern designs for learning experiences below.

Patterns connect in new complexities if they are given time and space to connect, if allowed natural rhythms of disintegration and reintegration, of ebb and flow, of the four seasons. Learning experiences designed as living systems need gestating spaces where things are allowed to percolate, jell, and simmer before they can transform (Ferrer, 2005). Nature has cycles of day and night and seasons for this process to unfold, and provides countless niches and spaces protected by soil, skin, and bark where components disintegrate and slowly reintegrate.

An educational framework that takes nature's rhythms into account must allow for unstructured times and spaces, as well as semi-structured times catalyzed perhaps only by a question or suggestion without requiring specific outcomes. As Dirkx (1997) noted, unstructured spaces can evoke presence of soul, and as Somé (1999) described earlier, they can deepen the transformative healing potential of a group. Designing for unpredictability and the emergent may not be an attractive idea for educators, as it may add to confusion and chaos. The guiding questions below are meant to provide some entry ways into venturing into this, thus far, less familiar way of instructional design.

Metapattern Educational Design Questions and Examples

Below I introduce a series of guiding questions and examples for living systems educational design. These questions are not prescriptive. Rather, they are intended to tap into the wisdom inherent in patterns of nature and send educators on an open-ended pedagogical journey. The questions and examples highlight opportunities primarily in the expressive, extra-rational,

structural-spatial, and rhythmic-temporal dimensions of learning experience design, which are the least developed dimensions in higher education.

Membrane Design Questions for Educators

- How can I facilitate a sense of belonging and group identity? How can I create a membrane for my course/workshop/conference?
- Which non-rational means of knowing am I comfortable introducing to create an energetic sense of belonging? What symbolic, metaphoric, or ritualistic gestures would help me in creating a visible/invisible membrane? Which other less commonly practiced ways of expression am I comfortable gradually introducing?
- How can I set up the physical space so it is conducive to creating a membrane effect?
- How can I allocate times at the beginning, end, as well as throughout the course or unit to allow the group energy to be gathered as a whole and sustained?

Membrane Design Examples for Educators

- Circular room setup; whole group spaces and functions dedicated to community building (possible online through virtual cafés or spaces for group creative expression).
- Opening and closing rituals, such as creating and taking down an altar, poems, appreciations, and dedications.
- Check-in and check-out times in council style (talking stick, participants listen to the one speaking without commenting).
- Intention setting; creation of ground rules.
- Mindfulness practices at beginning and end of classes, workshops, or conferences (meditation, mindful movement, body awareness and scanning).
- Exercises that evoke group consciousness and commitment (Macy & Brown, 1998)⁶.
- Icebreakers; collaborative group games.
- Celebrations and acknowledgements (new generations of students, outgoing generation, birthdays).
- Educators can prepare, nourish, and close the group field with their own spiritual and mindfulness practice (see Bache, 2008).

Patterns that Connect Organically – Design Questions for Educators

- How can I encourage my course (workshop, conference) to mimic patterns that connect in nature?
- Which natural patterns inspire me for the design of this course (i.e. meandering, branching, ripples, honeycomb patterns, web, etc.)?
- How can I stimulate organismically satisfying contact in my learning context (Fisher, 2002)? How can I encourage participants to connect with each other through the heart and from a deep soul-space? Which nonverbal modes of communication could be helpful?
- How can I honor the rhythm and pace of nature in the design of learning experiences? How can I design for active times as well as resting, integrating times (within a session, course, program, conference)? How can I allow for this learning experience to evolve through natural

⁶ e.g. Council of all Beings; Grief Mandala (Macy & Brown, 1998, Macy 2006)

cycles and seasons? Which rituals could serve in honoring cycles and seasons in the learning process?

- How can I balance structured, semi-structured, and unstructured times to allow enough time for self-organization, emergence, and “high levels of uncertainty, ambiguity, contradiction, and paradox” to nurture living systems as soulful systems (Dirkx, 1997)? How can I facilitate an agenda that leaves enough room for quality encounters with peers and is not too packed?
- How can I set up the learning space so that there are ecological niches where people can gather, hang out, and connect?
- How can I facilitate chance encounters and the meeting of people that may not otherwise connect?
- How can I facilitate cross-fertilization of ideas, people, and resources within and between systems boundaries? Across departments, disciplines, schools, communities? In town-gown partnerships?
- How can I provide opportunities for participants to give and receive heartfelt, authentic feedback?
- How can I set up ongoing feedback mechanisms to assess the health and functionality of the learning process as a living system?

Patterns that Connect Organically – Design Examples for Educators

- Milling exercise (Macy & Brown, 1998): Participants walk silently through the space, frequently changing direction until the facilitator asks them to stop in front of another person and be present with him/her, through eye contact or joining hands. The facilitator then guides these pairs through a nonverbal visualization or meditation in which each partner is asked to get in touch with the other’s life experience, including his/her pain for the world, yearnings, and strengths. A different set of qualities is highlighted with each round of milling, increasingly emphasizing the collective energy of both partners and all in the room.
- Macy’s *Work that Reconnects* offers many additional exercises stimulating heart-felt relating in pairs and small groups with frequently changing constellations (Macy & Brown, 1998, Macy, 2006).
- Conversation café (Brown, 2005): Small groups of people gather around café tables to explore questions that matter to everyone there. Participants listen for common patterns and deeper insights. After awhile, participants switch tables, with one participant remaining at the table, sharing the key perspectives of previous discussions, which encourages cross-pollination of perspectives. After several rounds of dialogue, insights are harvested as a whole group. This dynamic approach evokes collective creativity and elicits new approaches to engrained problems. Successfully applied in higher education by Bache (2008).
- Visual meeting facilitation techniques (International Forum of Visual Practitioners, 2010) to document meeting flow and highlight discussion threads.
- Open Space group facilitation technology (Open Space World, 2010).
- Physical setup rich in “living edges” and niches: places to sit and talk, pillows, snacks, places in nature for solitude and communal time; on-line individual reflection rooms where peers are encouraged to visit and give each other heartfelt feedback.
- Honoring the cycles of nature:
 - Active times (e.g. community engagement, design competitions, direct actions, celebrations).

- Integrating times (e.g. journaling; walks in nature; reflections with peer feedback; art; story-telling; drama; meditation; body mindfulness and movement; ritual).
- Systems games (Booth-Sweeney & Meadows; 2008) and case studies (Meadows, 2008; Pauli, 2010; Senge, 2006); to practice understanding systems dynamics in different contexts and applying systems principles to real-life projects.
- Capra's systems principles can be applied to generate questions assessing the health of social systems, such as a course, workshop, conference, or design project (Widhalm, 2010).

I am postulating that if educators pay attention to these living systems design considerations, autopoietic development will unfold organically, orderly disorder will erupt, and something will take over. At the same time, there will be a palpable sensation felt by some or all in the group that the learning experience has become a living organism, that it is pulsating with aliveness.

To that end, I encourage the educator to periodically reflect if an autopoietic process may be unfolding. Below, I offer questions to this end. I have developed these based on reflections of learning experiences I have participated in that have felt alive, vibrant, and have resulted in autopoietic developments (Widhalm, 2010).

Questions Inquiring about Autopoietic Developments

- Are there any new, unplanned developments that have emerged during this learning experience? (Connections, relationships, ideas, capacities for empathy and compassion, technologies, designs, calls for action, events, movements). Any positive ripple effects?
- What may have contributed to these developments arising?
- How can we acknowledge and celebrate these developments? How can we continue to nurture them into being and sustain them?
- Are members experiencing a felt sense of aliveness in the group? Is the group becoming comfortable with prolonged periods of "pregnant silence"? Is the group becoming more intimate? Are participants becoming more comfortable connecting with each other non-verbally?
- Is the group becoming comfortable with giving and receiving authentic feedback, including in areas of difference and conflict?
- Are participants beginning to co-create the learning experience and take co-responsibility for the wellbeing of the group?
- Is the group becoming more adaptable to shifts and unexpected changes?

If we see a number of these development unfolding, chances are, we are well on our way to facilitating a learning experience as an autopoietic living system.

Conclusion

The earth needs solutions that are autopoietic, solutions that can reverse the downward spiral caused by the industrial-growth-society. Higher education institutions have a core responsibility to become catalysts for the regenerative sustainability revolution called the Great Turning (Korten, 2007). Recent world events demonstrate that time is critical to radically ramp up efforts to educate effective change-makers for a sustainable world.

This article introduced a new framework for designing learning experiences as organic wholes that mimic living systems dynamics across multiple dimensions of learning. It is based

on the premise that learners who have developed living systems awareness at a cognitive, as well as heart- and soul-level will be much better prepared to take action.

I fully agree with panelists at the 2009 Bioneers pre-conference workshop on sustainability education that we need to teach systems thinking widely, deeply, and quickly. Yet, a cognitive understanding of systems alone cannot produce the solutions we now need. Life is of intelligence much greater than can be described or analyzed in any systems language. Hawken (2007), Macy (2006) and other leading sustainability and systems scholars have all noted *we need a resolve of the heart*. A world in which we do not allow for our hearts and souls to reconnect cannot become a sustainable world.

To create this generative heart-space requires a careful design of learning experiences that allows learners to open to deeper levels of connection and knowing than we are accustomed to in higher education. Learning experiences of any kind, whether they are courses, workshops, or conferences, have a much enhanced potential to catalyze the Great Turning if they mimic a living system across multiple dimensions of knowing and relating.

This article is my call to academia to create conditions for a radically more effective and affective way of teaching sustainability.

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