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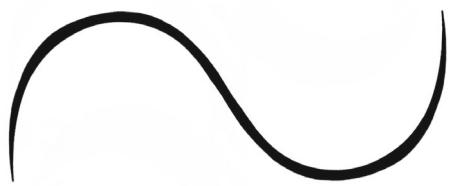
The Squiggle Sense

Sixth Sense
of the Complementary
Nature and the Metastable
Brain~Mind



The Squiggle Sense

Mtsbw!



May the squiggle be with you!

J. A. Scott Kelso · David A. Engstrøm

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Sixth Sense of the Complementary Nature
and the Metastable Brain~Mind



Springer

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*J. A. Scott Kelso dedicates his contribution to this work to his children, Jason, Jamie, Kate and Alex, and his grandchildren Liam, Caroline, McKenna and Cameron. And their children, and all children everywhere.
Mtsbwy. Always.*

David A. Engstrøm dedicates his contribution to this work individually to Lene, Forest, Chloe, Kenzie, Zoe, Janet, Sylvester and Pavlović and collectively to all humanity, all that have been and gone, alive today and yet to become. May you discover your squiggle sense. May the squiggle be with you!

Preface

The Squiggle Sense: Sixth Sense of the Complementary Nature and the Metastable Brain-Mind is an inspirational primer that connects human perception of the complementary nature with a new, empirically based theory of how the human brain-mind works. It's meant to be a companion, a personal reference that you can return to again and again. As a result, the hope is that you may see things in a different and more useful light. This book draws on the profound relationship between nature's many complementary contraries and the science of coordination called Coordination Dynamics (CD). Its purpose is to awaken and help you employ your "*squiggle sense*" in order to transcend the detrimental narrow-mindedness of polarizing, "either/or" thinking and behavior. The book follows on an earlier treatise (*The Complementary Nature*, MIT Press, 2006/2008) where we introduced a novel meaning for the squiggle (~) to symbolize the complementary nature of contraries like individual~collective, cooperation~competition and integration~segregation. Here, the behavior of both complementary aspects as well as the multistable and metastable CD that underlies them is captured by the *squiggle*. From the brain-mind's metastable mode of operation emerges a sentient faculty that physically senses and mentally perceives the complementary nature of itself and the world. This is *the squiggle sense*.

The world is wounded these days. Persistent dualistic, either/or thinking and behavior continues to be a major stumbling block to human development that foments polarization, side-taking, intransigence, intolerance and conflict. A less binary and binding vocabulary is needed. *The squiggle sense* offers a way out. The great physicist Niels Bohr said, "If you hold opposites together in your mind, you will suspend your normal thinking and allow intelligence beyond rational thought to create a new form". *The squiggle sense* can help you do this better and on purpose.

But how? Your brain-mind must enter its "metastable mode", where complementary metastable coordination tendencies coexist. CD provides a rigorous, scientifically grounded explanation of the metastable mode of brain-mind and how it leads to *the squiggle sense*. You are introduced to the paradigm shifting science of CD via a set of *squiggles* that capture core phenomena and principles. These *squiggles* are proposed to be universally applicable to any particular subject, field and level

of human interest and endeavor. They are used to explain how dynamic coordination patterns and brain~mind modes emerge and shift, and reciprocally, how the metastable mode of your brain~mind enables you to perceive and reconcile *squiggles*. Each time you are presented with apparent contraries or opposites joined by a *squiggle* symbol, you are meant to hold them together in your mind as complementary, coexisting tendencies. The role and goal here is to nudge your brain~mind into its metastable mode again and again. Contemplation of each archetypal *squiggle* is intended to pique and exercise your *squiggle sense* as you read about it. CD strongly indicates that contemporary life—mind, brains, people, society—is manifested via metastability. A person, group or society that realizes this, and intentionally exercises their *squiggle sense*, is called a Metastabilian.

Metastabilians wield *squiggle* power. Their intentionally engaged *squiggle sense* says, for example, “there is no individual without a collective, no parts without a whole, no competition without cooperation, no segregation without integration, no dwell without escape, no unity without diversity...”. *The squiggle sense* of your metastable brain~mind shows how these complementary aspects arise and function in complex systems. It is your personal skeleton key to the complementary nature. This book aims to inspire you to awaken and wield your *squiggle sense*. It invites you to pursue the perspective and paradigm shifting call of the Metastabilians—the call for an unprecedented evolutionary advance in human enlightenment. Although everyone has access to their *squiggle sense*, the complementary, metastable mode of coordination and consciousness, most remain unaware of it. You are probably unaware of it as such. Metastabilians are aware of it. Reading this book will make you aware of it. That awareness can lead to profound, novel advances in your life.

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01 Of Knowledge and Wisdom



Strange how things in the offing, once they're sensed, convert to things foreknown;
And how what's come upon is manifest only in light of what has been gone through.
Seventh heaven may be the whole truth of a sixth sense come to pass...—Seamus Heaney

A powerful and profound capability exists within you, a sixth sense called *the squiggle sense*. The *squiggle sense* is your *sixth sense* of the complementary nature. Your *squiggle sense* senses the dynamic dances of complementary contraries or “squiggles” of life, like part-whole, cooperation-competition, integration-segregation... The *squiggle* symbol (~) symbolizes the complementary nature of such complementary contraries. Like any of your senses, your *squiggle sense* can help you survive and prosper, learn and adapt to novel situations and understand life better. Yet it’s more likely than not to be unknown to you as a sense that you possess, a power you can wield. But once you learn about and sense it in yourself, you will suddenly feel that you’ve always known about it, and can start using it. This book is meant to help you do that.

Now, it turns out that *the squiggle sense* is grounded in and best understood via the paradigm and language of Coordination Dynamics (CD), the science of coordination. Indeed, existence of *the squiggle sense* is based on the discovery from CD that life’s complex systems, including human brains, are metastable, capable of expressing two complementary contrary tendencies at the same time. CD provides a theory of coordination that is broad and deep. It is tried and tested, and based on data collected from thousands of hours of experiments by many dedicated, professional scientists over the last 40 years or so. If you wish to delve deeper into this science, you can explore hundreds, if not thousands of peer-reviewed journal publications, encyclopedia articles, books, compilations, letters, editorials, lectures, videos, web pages and social media posts. It’s all there, the theoretical concepts, methods, mathematical models and tools, experiments and data, tables and graphs, analysis of results and conclusions, waiting for you to peruse. You are encouraged to study and explore the whole paradigm of CD, for in its details lie many profound concepts and discoveries.

That being said, it’s important to note that this book is not a treatise or defense of CD. Rather, it presents a unique perspective in which the knowledge gained from CD via research and discovery actually leads to wisdom of *the squiggle sense*: it offers a way for you specifically and humanity in general to overcome frequently encountered stumbling blocks in life, and heal, survive, prosper, and advance. The well-researched phenomena of CD are no less amazing than black holes and quarks. In fact, they’re arguably more relevant to you, at your scale, in your daily life. Together with the *squiggle sense* it grounds, CD offers you knowledge that is inextricable with wisdom. It provides an inspirational path that may well be a key to your and humanity’s future.



Only knowledge, only wisdom, either knowledge or wisdom, both
knowledge and wisdom, knowledge changing to wisdom,
wisdom changing to knowledge, between knowledge
and wisdom, neither knowledge nor wisdom,
beyond knowledge and wisdom...

The Metastabilian says: The knowledge I've gained from CD leads me to novel insights about the complementary nature, a sixth sense of it called *the squiggle sense*. I use the discovery and awareness of my *squiggle sense* to comprehend, explore, discover and express the complementary nature of myself, my life, my world, and even the CD it's grounded in. My *squiggle sense* reconciles knowledge and wisdom. The wisdom leads to new trajectories in my life, that in turn motivate exploration, discovery and acquisition of new knowledge...

Related squiggles: science~philosophy, facts~intelligence, learning~experience...

02 Of Beginning and End



What we call the beginning is often the end and to make an end is to make a beginning.
The end is where we start from—T. S. Eliot

This book was written to help you awaken, engage, train and wield your *squiggle sense* at will. Some effort is required to do this, but the potential benefits are many. The book is a collection of vignettes called *squiggle frames*, each providing a brief introduction to a *squiggle* important to and grounded in Coordination Dynamics (CD). Each *squiggle frame* is two pages long, a page-left and page-right. You're reading the second one now. The left pages begin with a numbered title, a small picture with a quote beside it, and three paragraphs of text. The right pages have a circular bubble with a *squiggle* title and illustrations that go with the text. Under the bubble is a short section called, “The Metastabilian says:” and a list of three “Related Squiggles.” A metastabilian is someone who intentionally engages and wields their *squiggle sense* of the complementary nature. All human beings have the potential to be metastabilians.

This modular format facilitates reading and rereading the *squiggle frames* in different ways and orders to stimulate, challenge and explore your *squiggle sense*! While at first it's probably best to read them in the order presented, there are as many ways to read them as there are combinations and permutations of the *squiggle frames*. You can begin at the end and end at the beginning! Or open your copy at random, read a frame, skip some pages and read another. Be creative. Follow your *squiggle sense*! Each *squiggle frame* offers a different perspective of the complementary nature and the Coordination Dynamics that scientifically grounds it. Each is meant to stimulate your *squiggle sense*, draw it out, teach it, such that you can learn to engage and wield it intentionally, so that you can become a metastabilian.

Reading different combinations of frames results in new associations. The idea is that you engage your *squiggle sense* more and more as you learn more and more about it. The more often you read the *squiggle frames*, the more variations you try, the more it will all make *squiggle sense* to you. As you explore these *squiggle frames*, try to notice if the *squiggle* you're reading about reminds you of aspects of your life—if novel, unexpected associations and relevancies to your life emerge spontaneously. Such associations can be cogent, insightful, even enlightening. Use them to enhance your life's trajectory. And whenever something in your life reminds you of one of the *squiggle frames*, let it remind you to open your book and begin a new reading. This book of *squiggle frames* is meant to be a companion, a personal reference you can return to again and again. As a result, you may see things in a different and useful light.



The Metastabilian says: In *No One Writes Back*, Jang Eun-Jin wrote, “It feels as though the beginning and the end are intertwined, thus leading to a never-ending cycle. Surely this will not be the end. Just as it can’t be considered the beginning. Just as it can’t be determined where the beginning or the end is.” My *squiggle sense* and the complementary nature it senses are like that. They’ve always been with me, even when I didn’t know it, and had no name for it. Now I’ve learned that my *squiggle sense* comes from the metastable mode of my brain~mind’s coordination dynamics. And each *squiggle* I sense reminds me that my *squiggle sense* is a skeleton key, a beginning~end of wisdom...

Related squiggles: start~finish, open~close, initiation~termination...

03 Of Mystery and Wonder



The most beautiful thing to experience is the mysterious, the source of true art and science—Albert Einstein

The Complementary Nature is a grand and mysterious coordination indeed—of life and death, energy and matter, conscious and unconscious, senses and movement, thoughts and emotions, reaction and anticipation, spontaneity and will. The mystery of it all sparks curiosity. It makes you wonder. Think of the dawning of your self, your first spark of awareness as a newborn, the first words you spoke and steps you took as a toddler. Wonder how you're able to stand and walk, think and talk, learn and remember, retain and relate, reflect and engage on so much information, so many facts, images and precious moments. How many times in your life have you wondered about those mysteries, like your body and mind, stars and planets, earth and sky, plants and animals, people and civilization—how all of it fits together? Your *squiggle sense* can help kindle and enhance your sense of mystery and wonder about life and nature.

Now consider the stunningly sobering fact that we human beings tend to set all this mystery and wonder aside. Too often we ignore, overlook, or just plain forget to wonder about these most beautiful things, the mysterious, the source of true art and science and 10,000 other pursuits. The challenges, stresses, expectations and worries of daily life often cause wonder to decline and fade away. Our sense of wonder seems to dissipate though the sources of wonder still remain. Think about it—even this attenuation of awareness, this habituation of the senses, is mysterious, something to wonder about. How does it happen, and is there a way back, a return to wonder? And how does that happen? And of course, the mysterious wonder of nature and nature of wonder remain. How does it all fit together? We are used to thinking about things as separate, but how are things (and namesakes like parts and processes) related? Are they *really* separate? Can the science of coordination help?

This grand project to reconcile human nature with nature at large, this mystery of mysteries, is crucial not only to you as a person, but the survival of our species, the leap to new stages of sentient awareness where new mysteries are waiting to be wondered about, discovered and explored. To this end, this book is written to inspire you to rekindle your wonder, your child mind. It is this innate curiosity and wonder that leads to new Eureka moments, which expand your awareness and enable new discoveries and fresh perspectives. Whenever everyday life seems to dull your *squiggle sense* of mystery and wonder—read this again!



The Metastabilian says: This work has become more precious to me as my *squiggle sense* has become awakened, as I have engaged, enhanced and expanded it. It inspires and motivates me upon my life's journey onward, as I appreciate and celebrate the mystery, wonder and illumination of the complementary nature and its scientific grounding in Coordination Dynamics. It is, all things considered, amazing to be alive and aware—we sentient creatures, coexisting upon this tiny blue island oasis among the vast and mysterious ocean of stars!

Related squiggles: ignorance~curiosity, question~answer, unknown~known...

04 Of Survival and Discovery



So I am always between two currents of thought, first the material difficulties, turning round and round and round to make a living; and second, the study of color. I am always in hope of making a discovery there, to express the love of two lovers by a marriage of two complementary colors, their mingling and their opposition, the mysterious vibrations of kindred tones—Vincent Van Gogh

Your squiggle sense can enhance your ability to navigate two fundamental currents of thought. First, those dealing with how to survive the daily material difficulties of your life, and second, how to make discoveries about yourself, your life and anything you're interested in. These two currents of thought are complementary—they're mutual, dynamically linked, and can't be meaningfully separated. To be able to study and make discoveries about your life's interests and pursuits, you must somehow navigate and negotiate the logistics of daily survival. The discoveries you make inspire and motivate you, compelling you to follow new paths of exploration, which alter the logistics of your daily survival. It goes back and forth, round and round, like the proverbial serpent swallowing its tail.

Now, before you can wield your *squiggle sense* and thereby enhance your existing abilities, you must first awaken and engage it. This is easier said than done. You will probably need to forgo, possibly even transcend some fixed ideas, attitudes and perspectives you take for granted that can block or drastically inhibit your sixth sense of the complementary nature. Ironically the *squiggle sense* becomes attenuated by the same kind of narrow-mindedness you use it to overcome. Work, stress, distractions, exhaustion and worries of all sorts can weaken the *squiggle sense*. So here's the challenge: how can you awaken and engage your *squiggle sense* and use it to enhance your ability to survive and to discover in your life? Becoming aware and gaining access to it is only the first step. Next, you must learn to engage your *squiggle sense* intentionally, wield it at will. You need to want to use it. If you can sense it but ignore it, it will fade into the background again, and be of little use. The *squiggle sense* is there to be discovered, but you have to realize and engage it yourself.

Amazingly enough, simply entertaining the idea that two contrary aspects of life like survival and discovery might be complementary is where your quest of the *squiggle sense* begins. Awakening and engaging your *squiggle sense* can enhance your ability to survive day-to-day as a person, and leap to new stages of awareness that can be used to *discover*, ponder and explore your life, your world. A key insight relevant to your quest is that these complementary abilities of survival and discovery are at their roots coordination patterns that can be understood and explained by Coordination Dynamics (CD). As hidden, unknown or attenuated as it's been up to this moment, contemplating the possibility of the complementary nature of CD sets your brain~mind in motion, and kindles your *sixth sense* of the complementary nature—the *squiggle sense*!



Only survival, only discovery, either survival or discovery, both survival and discovery, survival changing to discovery, discovery changing to survival, between survival and discovery, neither survival nor discovery, beyond survival and discovery ...

The Metastabilian says: I reflect upon the stunning discovery that my *sixth sense* of the complementary nature that motivates me to explore the mysteries of life is actually vital not only to my own personal survival, but the survival of the human species. What happens, then, when such a vital sense becomes depressed or obstructed—blinded by habits, fixations and intolerance—in this precious life in which we're attempting to survive and prosper, create and discover?

Related squiggles: viability~exploration, life~development, awareness~realization...

05 Of Polarization and Reconciliation



The garden reconciles human art and wild nature, hard work and deep pleasure, spiritual practice and the material world. It is a magical place because it is not divided. The many divisions and polarizations that terrorize a disenchanted world find peaceful accord among mossy rock walls, rough stone paths and trimmed bushes—Thomas Moore

Your *squiggle sense* reconciles opposites like art and science, work and pleasure, spiritual and material as inextricable, dynamic, complementary aspects of the complementary nature. They are not divided. But if you can't, don't or won't use your *squiggle sense*, opposites become divisions and polarizations that can terrorize and disenchant the world. In them you can find no peaceful accord, no tenable middle way: "My way or the highway!" "Either with me or against me!" "Whose side are you on?" "Either us or them!" Sadly, we do not live in a *squiggle-aware* world. Polarization remains one of humanity's greatest stumbling blocks, both a root cause and consequence of a world divided. The news (both factual and fake) is inundated with stories of *polarization* and its devious narrow-minded siblings—extremism, intransigence, intolerance and hubris. You shake your head at it all, thinking, "It's so frustrating! Can't anything be done about this...*Ridiculum*?".

Actually, there is at least one thing you can do. You can engage your *squiggle sense* whenever and wherever you can. And if it's engaged right now, you might wonder if polarization and reconciliation *squiggle*? If they do then Coordination Dynamics (CD) should be able to provide scientific insight into both and their relationship. In fact, CD does provide the means and ends to understand polarization and reconciliation, and their complementary nature. Learning about CD can help you gain a novel, scientifically grounded world view that, if embraced, can save you from toxic narrow-mindedness. Via CD, you sense and understand the polarities of life as idealized aspects of a far more extensive, mind-expanding phenomenon that sweeps dynamically between them. This is the *squiggle sense* of the complementary nature.

CD provides a natural basis for polarization, and how it can lead to getting stuck in one mode of thought versus another—either/or thinking. Even more importantly, CD shows how polarized tendencies may coexist at the same time, a crucial phenomenon called metastability, which provides both a scientific basis and a syntax for polarization~reconciliation. Metastability's ability to explain apparently irreconcilable opposites as complementary aspects of a single reality offers deep insight into the human condition and a basis for genuine human action and change. It's also the basis of the *squiggle sense* which, if embraced can enable humanity to transcend ubiquitous polarization and quell at long last the corrosive culture of seemingly eternal conflict. As Joni Mitchell wisely wrote, "we are stardust, billion year old carbon, we are golden, caught in the devil's bargain, and we've got to get ourselves back to the garden...".

The either/or mode

Either... beginning or end, one or many, brain or mind, whole or parts, instinct or learned, nature or nurture, expert or novice, cooperation or competition, love or hate, freedom or constraint, wrong or right, friend or enemy, us or them, life or death, individual or collective, evolution or design, order or chaos, tradition or progress, form or function, efficacy or toxicity, supply or demand, faith or reason, professional or amateur, mind or matter, stability or instability, leader or follower, public or private, business or pleasure, right or wrong, us or them, democrat or republican, conservative or liberal, religious or secular, genetic or environmental, mind or body, agree or disagree, design or evolution, science or philosophy, work or leisure, black or white, good or evil, right or left, rich or poor, fantasy or reality, analytical or artistic, logic or intuition, private or public, bound or free, mental or physical, actual or virtual, human or machine, science or religion, choice or chance, academic or commercial, beautiful or ugly, genotype or phenotype, centralized or distributed, creative or destructive, organism or environment, mechanistic or holistic, male or female, young or old, yours or mine, winner or loser, conscious or unconscious, creation or evolution, rich or poor, idealist or realist, believer or nonbeliever, random or determined, freedom or security, with or against...

Only polarization, only reconciliation, either polarization or reconciliation both polarization and reconciliation, polarization changing to reconciliation, reconciliation changing to polarization between polarization and reconciliation, neither polarization nor reconciliation, beyond polarization and reconciliation...

The Metastabilian says: The philosopher Colin McGuinn said, “Despite the unifying efforts of Enlightenment thinkers, modernity has been structured around fracture lines, like the mind/body problem, the nature/nurture problem, free will versus determinism and secularism or faith... our current intellectual predicament reflects a long history of doubt and debate in which the competing notions of machine and soul still struggle. It is enough to make one think that we need a radical reconceptualization of the entire problem, if indeed that were humanly possible”. My *squiggle sense* says it is possible: It is precisely such detrimental either/or thinking and acting that my *squiggle sense* transcends, due to the metastable CD of my brain~mind.

Related squiggles: integration~segregation, togetherness~apartness, unity~division...

06 Of Contraries and Complementarity



If you hold opposites together in your mind, you will suspend your normal thinking process and allow an intelligence beyond rational thought to create a new form—Niels Bohr

Your *squiggle sense* allows you to hold opposites in your mind, suspending your normal thinking process and allowing an intelligence beyond rational thought to create a new form. It senses the complementary nature as myriad dances of what Niels Bohr called, *contraria sunt complementa*: contraries are complementary. Somehow he was able to hold opposite theories of light (as waves and as particles) in his mind and suspend normal ways of thinking about them. This allowed an intelligence beyond the usual way of thinking about competing theories (is light a wave or a particle?) to create a new form, which became known as the Complementarity Interpretation of Quantum Mechanics (QM). For Bohr, whether light is a wave-like or particle-like phenomenon depends on the experimental arrangement used to measure it. Strange but true.

QM is one of the most successful scientific theories of all time, and Bohr's Complementarity Interpretation of it is the one accepted by most physicists. Complementarity works at atomic and subatomic levels. But is it generalizable? There are many complementary contraries in nature besides waves and particles. Just how many there are is unknown. Of course, you are probably aware that the ancient Chinese principle of yin and yang is held as a general complementarity principle, applicable at all levels of nature. Yin and yang is an archetypal pair of complementary contraries, thought to be coexistent, inextricable, dynamic. Ironically though, the pair was believed to spring from the ineffable Tao—too great to be expressed or described in words, let alone studied scientifically.

Stimulated (by his awakened *squiggle sense?*) and inspired by his successful but specific interpretation of complementarity at the quantum level, Bohr sought to discover a general scientific complementarity theory, applicable at all levels great and small, living and non-living—a principle of a complementary nature. The situation was ironic: a modern, specific complementarity grounded in physics but missing a generalized form, and an ancient general complementarity lacking scientific grounding. Bohr immortalized this irony on the shield commemorating his Danish knighthood by including a yin-yang symbol in the coat-of-arms of his design with latin motto, *contraria sunt complementa*. Unfortunately, this goal was not achieved in his lifetime and until recently, there has been little progress made towards Bohr's grail. Coordination Dynamics (CD) provides a compelling, general, scientific grounding of complementary contraries, able to explain how they emerge, coexist and change. For this reason, CD has been dubbed, “the new science of The Complementary Nature”.



The Metastabilian says: *Contraria Sunt Complementa*, or complementary contraries, is the motto on Bohr's Shield. The complementarity of particle and wave behaviors of light which inspired it is very specific, scientific and modern. Yet, the ying-yang symbol is philosophical and ancient. The shield captures Bohr's grail, the advent and development of a scientifically tenable Generalized Complementarity Principle. And now, Coordination Dynamics not only presents us with a science of The Complementary Nature, but scientifically grounds my *squiggle sense* that senses that complementary nature. Amazing!

Related squiggles: opposites~complements, polarization~reconciliation, contraria~complementa...

07 Of the Squiggle Sense and the Complementary Nature



Just as in the organization of the physical world with which it interacts, it is proposed that the brain is organized to obey principles of complementarity, uncertainty, and symmetry-breaking. In fact, it can be argued that known complementary properties exist because of the need to process complementary types of information in the environment—Stephen Grossberg

Your *squiggle sense* (TSS) is the *sixth sense* of the complementary nature (TCN). Its awakening leads to a new mindset and new wisdom grounded in the science of Coordination Dynamics (CD) with its many fascinating phenomena and the theoretical concepts, methods and tools it employs to understand them. CD is a science of the complementary nature, that is, a nature entailed and defined by a core principle of complementarity that runs all the way through it. This is an ancient idea, exemplified by the principle of yin and yang in Eastern philosophy as well as the concept of Dialectic in Western philosophy, and courses broadly in many guises and contexts through the entire history of ideas. In this modern age of science and technology, you are probably at least casually familiar with the importance of the complementary nature in Quantum Mechanics (QM). Indeed, the vanishingly tiny quantum world of particles and waves is so complementary that one of the most important and successful interpretations of QM is actually called Complementarity.

You yourself are a complementary creature of the complementary nature, from bottom to top, left to right and front to back. The genetic code of DNA in all your cells is a combination of just two complementary pairs of nucleotides, namely adenosine~thymine (A~T) and cytosine~guanine (C~G). The coordinated dances of your DNA and proteins are also complementary dances, their dynamic patterns and pattern dynamics comprising the complementary structure and function of your complementary body and mind. The inhalations and exhalations of every breath you take, the systoles and diastoles of all your heartbeats from the cradle to the grave involve coordinated movements most complementary.

Your brain~mind is complementary, matching the complementary nature it is produced by, your perceptions and actions, reactions and anticipations, learnings and memories. Your cognition is complementary, your thoughts and emotions, both conscious and unconscious. Your behavior, the coordinated expression of the many things you do that make and define you, is complementary! Your spoken and body language, your social interactions as an individual in a family and community of other people are all complementary coordination patterns. What about your *squiggle sense*? Well, it's as complementary as complementary can be! That you, a marvelous and able sentient being living amidst the cosmos possess a sense, a sixth sense, that is sensitive to the very complementary nature that has produced you, is quite literally as sensible as a sense can be!



The Metastabilian says: It makes *squiggle sense* to me that my body and brain-mind that enables me to be sentient and aware should somehow match the complementary nature that produces it—to grow and develop, learn, survive, discover and interact with, live, love and experience. It's extraordinary to realize that my *squiggle sense* of the complementary nature not only senses, but is a complementary aspect of it. It is a sixth sense, a way to sense the complementary nature of the heavens, my world and myself...

Related squiggles: awareness~reality, metastability~complementarity, brain~environment...

08 Of Coordination Dynamics and the Complementary Code



Present-day physics is running into obstacles of various kinds. It is argued that the cause of the problems is the fact that physics lacks tools appropriate to gaining a clear understanding of complexity. Alternatives such as that of coordination dynamics are likely to lead to a new level of understanding of nature, including the role played by mind—Brian Josephson

Your *squiggle sense* is both a *sixth sense* of the complementary nature and a phenomenon of Coordination Dynamics (CD). When you engage and wield your *squiggle sense*, you're *doing* coordination dynamics. From here on in, all the *squiggle* frames are about *squiggles* that comprise the complementary code (TCC) of CD. So you're going to learn about CD, which grounds your *squiggle sense* in science, via its complementary nature, its complementary pairs, its *squiggles*—using your *squiggle sense*! But what is CD? To begin, realize that coordination is in you and all around you, everywhere you look—in your DNA, genes, proteins, cells, organs, the neurons of your brain that allow you to perceive the world, remember, decide and act. And then there is coordination among people. All is a coordinated dance at all levels and scales. In fact, the coordination of living things is one of the great mysteries in the science of life.

CD showed that coordination is an emergent, self-organizing process, where the many diverse components of a living system come together to form coherent, meaningful patterns of behavior. It studies how these coordination patterns form, persist and change, regardless of the many differences between the parts and processes involved. In CD, principles and mechanisms underlying coordinated behavior are identified in different fields and functions, in multiple systems and multiple levels of observation. CD is an approach to understanding how coordination works in nature's complex systems, including certain aspects of human nature such as intention, learning and emotion. CD began with very basic experiments on the coordination of human hand movements and was then extended to the coordination between touch, vision, sound and movement and the neuronal patterns that accompany them. More recently, CD has been extended to social coordination within~between brains and between people and machines, even to understanding team and crowd behavior.

From these roots, CD's influence has spread to different fields like philosophy, education, law, ecology and economics, and has useful applications in medicine, therapeutics and sport science. While such diverse systems and levels are very different in many ways, a deep connection between all of them is found in the dynamical principles and mechanisms of CD, especially metastability. CD's essential elements can be expressed via a codified set of concepts which is open and continues to evolve. It turned out that these were none other than a complementary code—the *squiggles* of CD. This discovery elevated Coordination Dynamics to its updated status as a science of the complementary nature—which you can learn about using your *squiggle sense*!



The Metastabilian says: And now I realize that Nature itself, Mother Nature, human nature, our nature—is at its core complementary through and through. In everyday language, CD provides me a vehicle, a means to explore and understand how the complementary nature works at any scale of magnitude I wish to study or express, in any viable system and in any context I wish to study it. CD, together with my awakened squiggle sense, provide a way forward for me personally as well as my ability to share it with others. CD's Complementary Code (~) and its many realizations are an invaluable aid that help me to do it!

Related squiggles: all of the above! ~;)

09 Of Squiggles and Dynamical Modes

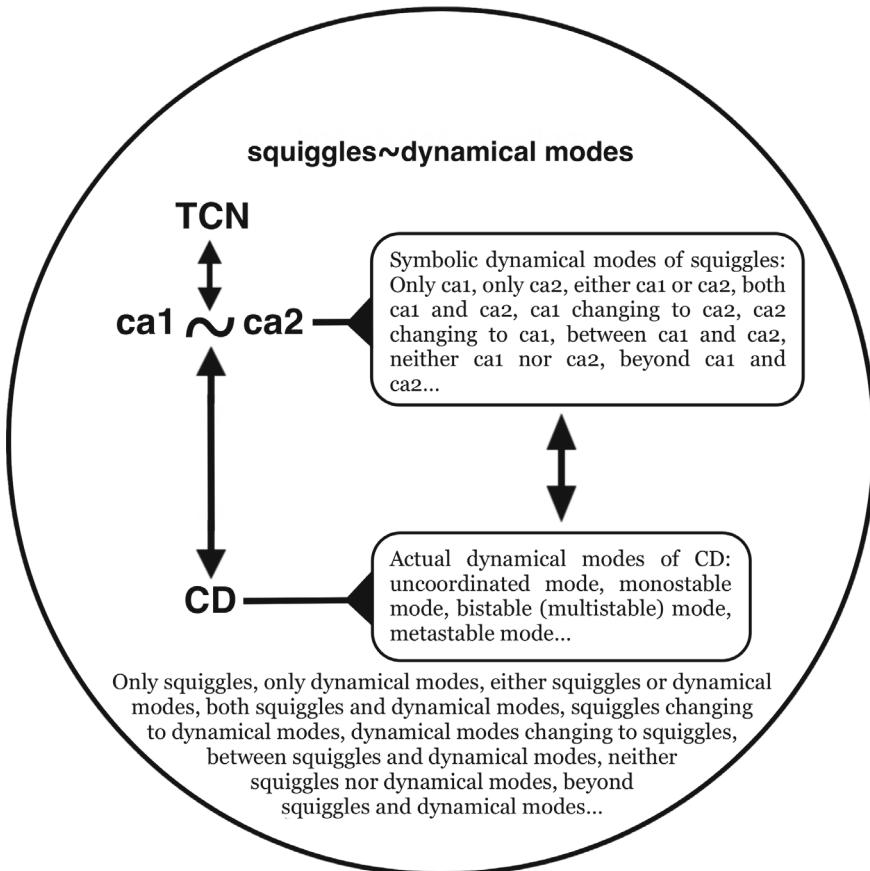


To us... the only acceptable point of view appears to be the one that recognizes both sides of reality—the quantitative and the qualitative, the physical and the psychical—as compatible with each other, and can embrace them simultaneously It would be most satisfactory of all if physics and psyche (i.e., matter and mind) could be seen as complementary aspects of the same reality—Wolfgang Pauli

Your squiggle sense senses the complementary nature (TCN) of *squiggles* like physics and psyche, matter and mind, body and soul. It enables you to recognize them as compatible with each other, to embrace them simultaneously, to see them as complementary aspects of the same reality. While this same profound and useful insight has been expressed by many thinkers throughout the history of ideas, it has proven to be quite difficult to express and share with the general populace, and continues to be widely unknown and under appreciated to this day. Reversing this trend is a main goal of this book. A simple but powerful notation has been developed to accomplish this goal. In it, pairs of possible complementary aspects like brain and mind are written with a *squiggle symbol* (~) between them, as in brain~mind. This is one reason why they're called *squiggles*, and the sixth sense of them, the *squiggle sense*. The generic written form is ca1~ca2, where 'ca' stands for complementary aspects. Its spoken form is, "c-a-one *squiggle* c-a-two".

The *squiggle* (~) stands for the inextricable, dynamic, complementary nature of any pair of complementary aspects. It also implies a set of archetypal dynamic patterns or dynamical modes of TCN. Symbolic dynamic modes of the generic ca1~ca2 squiggle are: [only ca1, only ca2, either ca1 or ca2, both ca1 and ca2, ca1 changing to ca2, ca2 changing to ca1, between ca1 and ca2, neither ca1 nor ca2, beyond ca1 and ca2]. This ongoing *squiggle* dance between and within a *squiggle*'s dynamical modes is what your *squiggle sense* senses. But how are *squiggles* produced? How do they work, how are they related to each other and how is TCN to be understood? What drives the dance of its dynamical modes? Where does the *squiggle sense* come from?

Answers to all these questions come from Coordination Dynamics (CD). Besides their complementary nature, the *squiggle* ‘~’ also symbolizes the set of actual universal dynamical modes of coordination produced, studied and theoretically modeled in the science of CD: (uncoordinated mode, monostable mode, multi-stable mode and metastable mode). The correspondence between the *squiggle sense*, the conceptual awareness and appreciation of complementary aspects, the symbolic *squiggle* notation, dynamical modes of *squiggles*, and the dynamical modes of coordination in CD constitute the basis of the ‘scientific grounding’ of TCN, *squiggles* and the *squiggle sense*. The dynamical modes of a *squiggle*, the actual phenomena, are in fact different dynamical modes of CD.



The Metastabilian says: The *squiggle* notation ‘ca1~ca2’ and symbol ‘~’ enhance my *squiggle sense* of the complementary nature (TCN). They provide a useful syntax for dynamical, inextricable, complementary aspects of *squiggles* that I can use to contemplate, study, express and communicate their qualitatively different symbolic dynamical modes. The notation is even more powerful and compelling as the symbolic dynamical modes of *squiggles* correspond to actual dynamical modes of CD. In turn, the syntax provides a lucid way to think about and comprehend the *squiggles* of CD, called ‘The Complementary Code’ (TCC).

Related squiggles: symbol~dynamics, syntax~semantics, TCN~CD...

10 Of Theory and Experiments

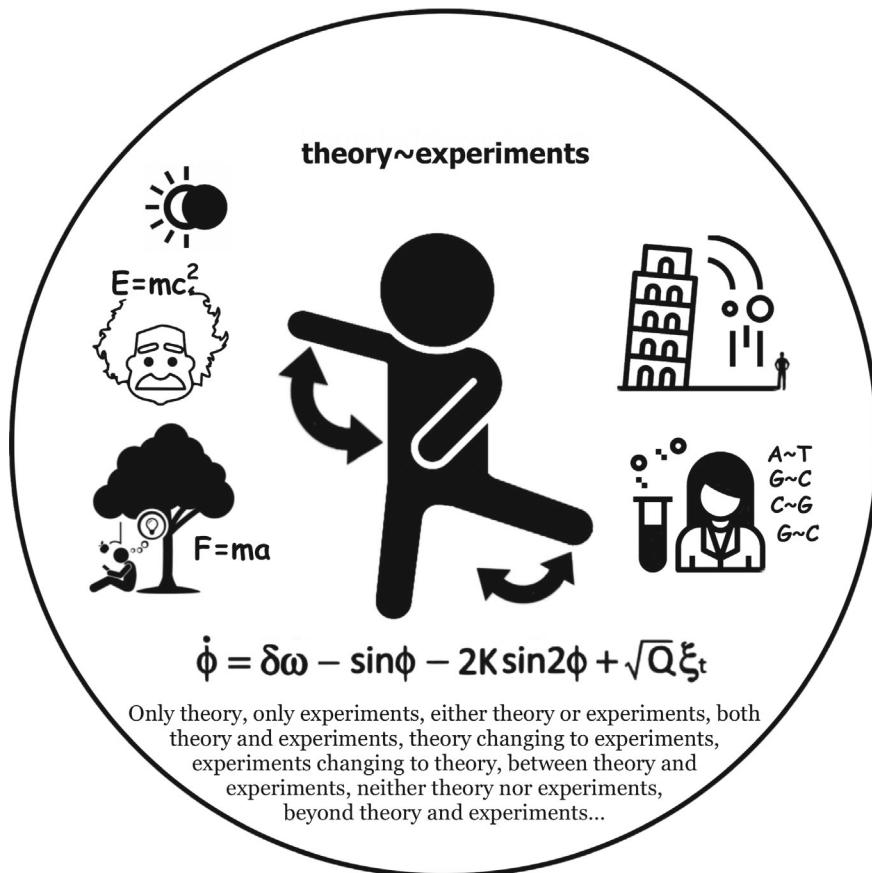


To me, what makes physics physics is that experiment is intimately connected to theory. It's one whole—Lene Vestergaard Hau

Your *squiggle sense* is grounded in the science of Coordination Dynamics (CD). What this means is that both your *squiggle sense* and the coordinated dances of the *squiggles* it senses can be understood and explained by CD in two main ways: (1) as phenomena of CD, that is, as observable facts and measurements about objects and events discovered or obtained by experiments; and (2) as noumena of CD, that is, as posited conceptual elements or principles of theory, which are most effective when expressed in the language of mathematics. Your engaged *squiggle sense* should be blinking now, as you ponder the complementary nature of phenomena~noumena, theory~experiments, concepts~observables, ideas~applications... What other *squiggles* come to mind right now? Make an experiment of your own!

In CD, all of its experiments are intimately connected to the theory and the development of models, and vice-versa. New experimental observations lead to new theoretical models, which as a result lead to the design of further experiments to test model predictions, and so on. Such is the normal course of science and the scientific method. The complementary nature of CD entails conceptual noumena and observable phenomena, both of whose origins and dynamical behavior are central to CD's theoretical~experimental scientific paradigm. That many of CD's *squiggles* have been described since antiquity is not surprising. What has transpired over the last 40 years or so, however, is that CD has provided novel perspectives and insights into where these *squiggles* come from and our awareness of their complementary nature.

In the remaining *squiggle* frames, the theoretical~experimental paradigm of CD is unpacked via its *squiggles*, its complementary code. But here's a little taste of it to get you started: As we have already noted, students of CD seek to identify the laws, principles and mechanisms underlying coordinated behavior in all kinds of different systems and contexts. CD explicitly addresses coordination within~between levels, intra- and inter-actions between bodies, brains and environments. The original experimental paradigm that led to CD involved the coordination of human finger movements. From these simple experiments and the many extensions and variations they inspired, a deep understanding of the nonlinear dynamics of the human brain and its relation to behavior ensued—the current theoretical~experimental paradigm of CD was born!



The Metastabilian says: What better place to discover a general principle of nature than in the Coordination Dynamics of animate movement! All the signatures of the complementary nature are present. An amazing feature of CD is that its entire theoretical-experimental strategy can be captured by its complementary code, TCC of CD, the set of *squiggles* that comprise its conceptual-phenomenal boundary-domain. This is a very handy insight, since it implies that the *squiggles* in any viable system at any level that attracts my interest can be explored, comprehended and expressed via CD.

Related squiggles: concept~model, noumena~phenomena, ideas~observables...

11 Of Brain and Mind

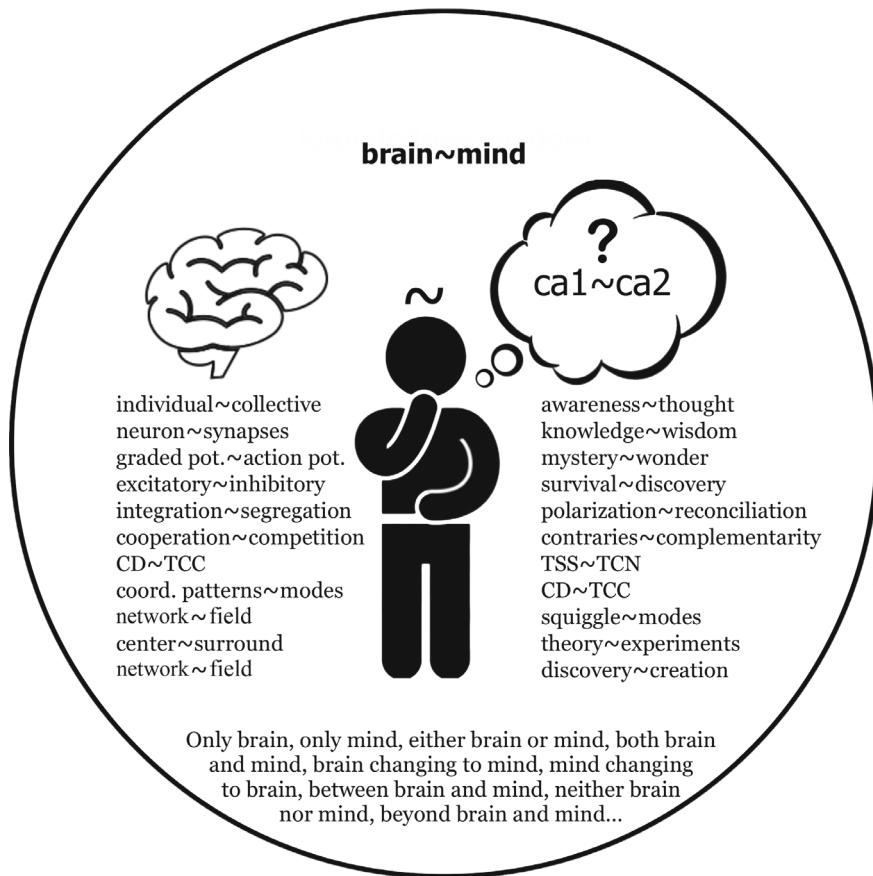


...the splitting off from each other of religion, morals and science; the divorce of philosophy from science and of both from the arts of conduct. The evils which we suffer in education, in religion, in the materialism of business... in the whole separation of knowledge and practice—all testify to the necessity of seeing mind–body as an integral whole—John Dewey

Your *squiggle sense* is by definition a sixth sense of your brain and mind. It's something your brain actually does. It's physical, physiological. It's also something your mind does. It's mental, psychological. Hopefully, your engaged *squiggle sense* will now help you transcend the mind-numbing, seemingly never-ending, polarizing debates over which is more primary, brain or mind (body or mind, matter or mind...). Or how matter makes mind and mind makes matter. Coordination Dynamics (CD) sees the dynamic, inextricable dance of your brain and mind as dynamic complementary aspects of a *squiggle*. And your brain~mind produces your *squiggle sense*, your *sixth sense* of the *squiggles* of the complementary nature.

What's more, the complementary nature of brain~mind, like all *squiggles*, is grounded in CD. Another way to say this is that the *squiggle sense* of your brain~mind can be studied, understood and explained within the paradigm and language of CD. Moreover, studies of one of the dynamical modes discovered in CD, called metastability or the metastable mode, has led to an entirely novel conception of how the brain~mind works. In the metastable mode of brain~mind dynamics, tendencies for individual regions of the brain to function as specialized, segregated entities coexist with collective, coordinative tendencies for them to bind together and integrate as functional coalitions. The discovery of the complementary nature of integration~segregation tendencies in the metastable mode of brain~mind dynamics is elegant and profound. It sheds light on many mysteries of human capabilities, thought and behavior.

The main one is that the metastable mode of brain~mind produces your *squiggle sense*. The kindling of your *squiggle sense* coincides with a shift of your brain~mind CD to its metastable mode. Brain~mind metastability is the unique signature of the complementary nature. Once you realize this, you become highly sensitive to it. Metastability shows how apparently contrasting properties of the brain and mind coexist, and how they may be reconciled. “Pure” states of integration or segregation are interpreted as polarized, idealized extremes of a vast dynamical landscape that sweeps flexibly between them. Taking stock, the complementary nature of CD *squiggles*, as do all its complementary pairs. And with your metastable based brain~mind’s *squiggle sense*, you perceive and act upon the complementary nature of your world.



The Metastabilian says: Coordination of brain~mind is like a Ballanchine ballet—neural groups and thoughts briefly couple, some join as others leave, new groups form and dissolve, creating fleeting dynamical coordination patterns of mind that are always meaningful but don't stick around for very long. Such transient coupling~uncoupling tendencies within~between individual brain regions and within~between thoughts and actions underlie the workings of the brain~mind and its complementary nature. Incredible!

Related squiggles: physical~mental, body~mind, behavior~cognition...

12 Of Metastable Mode and Complementary Code

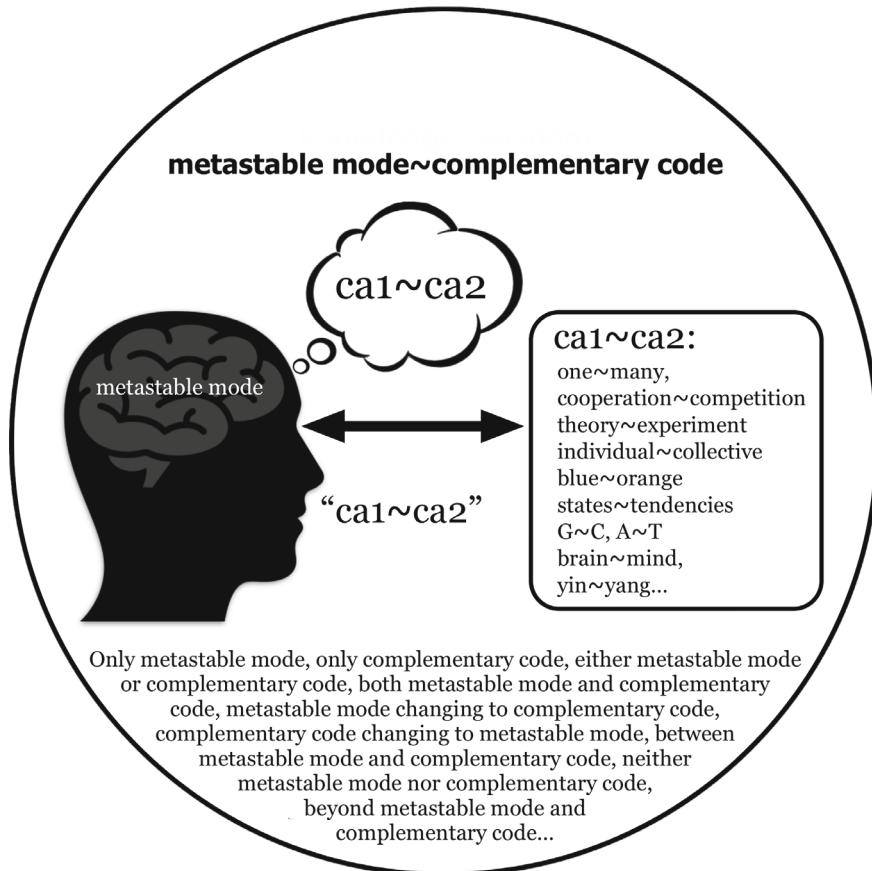


The test of a first-rate intelligence is the ability to hold two opposed ideas in the mind at the same time, and still retain the ability to function—F. Scott Fitzgerald

Your *squiggle sense* becomes engaged when you enter your brain-mind's metastable mode. In these moments, you can tune in to the complementary nature of your world as a realization of your brain-mind expressing itself. While in your metastable mode, you're able to sense, perceive, experience the dynamic mutuality of complementary aspects. In those moments, you have the ability to hold two contrary ideas in your mind at the same time and still retain the ability to function! In Bohr's words, you're able to "hold opposites together in your mind, suspend your normal thinking process and allow a first-rate intelligence beyond rational thought to create new forms and ideas." But then what? What do you do with that?

Start by realizing that your brain-mind operates in its metastable mode many times a day, even if you aren't aware of it as such. If you aren't aware of it, your *squiggle sense* is, as it were, "flapping in the wind". In those moments, what comes of the complementary stimuli presented to you, whether valuable, useful, disturbing, random or inconsequential, is catch-as-catch-can. The irony in this case is that you have a powerful, vital sense available to you that is operational yet often acting independently of your will. This futile situation is what the complementary code helps you to overcome, giving you a way to recognize, engage, make sense and wield your *squiggle sense* intentionally. The complementary code of CD presented in the *squiggle* frames of this book give you a way to intentionally engage and develop your *squiggle sense*.

The *squiggle* notation 'ca1~ca2' symbolizes the *squiggle sense* of any given, or even potential complementary aspects. The *squiggle* (~) not only symbolizes the coexistence of complementary aspects, but also their Coordination Dynamics (CD)—the different possible dynamical modes or coordination patterns and transitions between them. The *squiggle* (~) of the Complementary Code also symbolizes both the *squiggle sense* itself and the CD that gives rise to all of your potential brain-mind's dynamical modes, especially its metastable mode. Without the complementary nature and metastability, there would be no complementary code to express, nor anyone to express it to. The metastable mode grounded in CD and the complementary code it gives rise to are inextricable, dynamic and complementary. They are themselves complementary aspects of a *squiggle*, whose *squiggle* dance is crucial to the sentient call of Metastabilians.



The Metastabilian says: How do you engage your *squiggle sense*? One way is to play The *Squiggle Game*. All you need is the complementary code! (1) Choose any pair of contraries, and write them as a *squiggle*, like ‘choice–chance’. (2) Under the *squiggle*, write out its *squiggle expansion*—Only choice, only chance, either choice or chance, both choice and chance, choice changing to chance, chance changing to choice, between choice and chance, neither choice nor chance, beyond choice and chance... (3) read through the expansions and try to ‘imagine’ each member of the expansion set several times from first to last, then last to first. Then try skipping around. (4) Try your *squiggle* scans to a metronome, from slower to faster, then faster to slower. (5) Remember the goal: to enter the metastable mode of your brain–mind; to engage your *squiggle sense*.

Related squiggles: metastability~complementarity, dynamical~symbolical, noumena~phenomena...

13 Of Dynamic Patterns and Pattern Dynamics

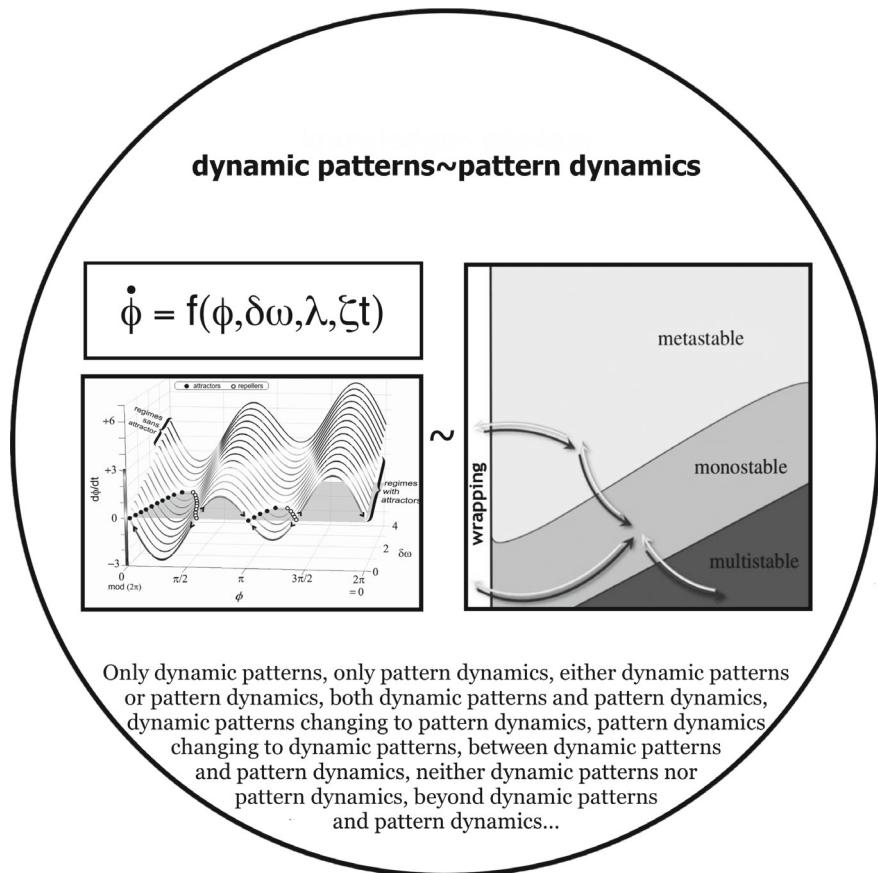


Coordination dynamics reveals the coordination of life as an emergent, self-organizing process where many diverse parts of a living system synergize to form coherent, meaningful dynamic patterns of behavior—J. A. Scott Kelso

The Coordination Dynamics (CD) that grounds your *squiggle sense* in science treats the coordination of your brain~mind as an emergent, self-organizing process in which its many diverse complementary aspects gang together to form coherent, meaningful dynamic patterns of behavior. One of these coherent, meaningful dynamic patterns is called metastability, or your metastable mode. Not only is your *squiggle sense* a coherent, meaningful dynamic pattern of your brain~mind's metastable mode, it also senses dynamic patterns of the complementary nature, its *squiggles*. CD is a science of the complementary nature of your brain~mind's dynamic patterns. CD also derives from your brain~mind's dynamic patterns, the dominant form of which is the creative metastable mode that underlies your *squiggle sense*.

In the paradigm of CD, dynamic patterns of brain activity produce your thoughts and emotions, the learning and memory that leads to your knowledge and wisdom, mystery and wonder, survival and discovery, your movements and skills—basically everything you are and do as a human being! As such, one of the main tasks of CD is the discovery, identification and characterization of the many specific dynamic patterns produced by different systems and levels of living systems and the relations between them. Another is the elucidation and study of the underlying pattern dynamics, the laws that generate observed dynamic patterns. Pattern dynamics is the universal set of principles and laws by which dynamic patterns of emergent, self-organized processes of all systems and levels emerge, persist, evolve and change.

Pattern dynamics is a fundamental pillar of the CD paradigm. An amazing fact about CD is that although the information required to characterize nature's dynamic patterns is, in principle, near infinite, all the complexity is enfolded into a self-organized pattern dynamics that follows much simpler, albeit nonlinear, universal laws. A main insight of CD is that the entire repertoire of dynamic patterns and universal pattern dynamics can be recast as a base set of complementary pairs or *squiggles*, which now constitute 'the complementary code of coordination dynamics' (TCC). Dynamic patterns~pattern dynamics is a principal *squiggle* of the complementary code of coordination dynamics. It's one of those *squiggles* upon which the science of your *squiggle sense* depends.



The Metastabilian says: I'm an emergent, self-organized, complementary being, whose many diverse complementary aspects form coherent, meaningful dynamic patterns of structure~function and whose pattern dynamics consist of multiple unique dynamical modes of coordination. My squiggle sense discovers~explores the complementary nature of my world and myself. The complementary code of CD and its scientific grounding of dynamic patterns~pattern dynamics bolsters and stimulates my understanding, confidence and expression of *the squiggle sense*.

Related squiggles: phenomena~laws, code~meaning, squiggles~CD...

14 Of Self-Organization and Agency



“γνῶθι σεαυτόν”—Delphic Maxim, inscribed in the forecourt of the ancient temple of Apollo

“Know thyself” is an ancient Delphic maxim, a piece of timeless wisdom. It’s also the ultimate conundrum, your personal daily paradox. Self-awareness is a taproot of your existence. It plays a major role in all that you are and do, even if you don’t pay attention to it. Like everything else about yourself, self-awareness is a product of the complementary nature. To really know yourself is to know the complementary nature of yourself. This is an extraordinary insight: to know yourself, you need your *squiggle sense*! And that means your brain~mind must shift to its metastable mode. How you do that will always depend on many factors, not all of which can ever be specified. But reflecting upon the complementarity of self-organization and agency is a good place to start, as this *squiggle* is arguably the bullseye of the conundrum!

Self-organization, or the spontaneous formation of dynamic patterns, occurs in *open systems* that exchange matter, energy and information with their surrounding environment. No specific ordering, programs or prescriptions are responsible for the emergence of these dynamic patterns. They arise solely as a result of properties typical of open systems, like many fluctuating elements, nonlinear interactions between them and dissipation of free energy. In such conditions, open systems organize themselves! In CD, such spontaneously arising patterns are referred to as intrinsic dynamics. Of course, you’re not exclusively driven by your self-organized intrinsic dynamics. Your thoughts, desires, memories and intentions can also direct your actions and lead to your deeds. In scientific language, this directedness of life is called agency, or action towards an end.

Agency began for you in utero with spontaneous movements, your arms and legs waving and kicking, mouth opening and closing, body bending and twisting. You came into the world moving. This repertoire of basic spontaneous, self-organized coordinated movements formed before you even knew how to make them, even before you were aware *you* were making them. Yet, through the internal~external sensations arising from this basic movement repertoire, you discovered it was your own. In CD, spontaneous self-organizing coordination tendencies give rise to agency, which is then able to steer the very coordination dynamics that produces it. Directed self-organization is when spontaneous pattern forming tendencies and agency coexist and complement each other. From such spontaneous self-organized behavior your self emerges—“I do therefore I am”. Your *squiggle sense* is such a self-organized process. You are the agent that directs it, and so can come to know yourself.



The Metastabilian says: To know myself is to know the complementary nature of myself. And so I must sense the complementary nature of myself, must perceive its self-organizing intrinsic dynamics such that I can learn to interact with and finally direct it at will. And to accomplish that action towards end, that agency, I must engage my *squiggle sense*. And for that, I must shift my brain-mind to its metastable mode. And so to know myself, I must become my Metastabilian self!

Related squiggles: action~perception, brain~mind, curiosity~awareness...

15 Of Intentional Action and Intrinsic Dynamics



Intending, one does karma (acts) by way of body, speech, and intellect—The Buddha, Nibbedhika Sutra, Anguttara Nikaya 6.63

As an infant, your spontaneous, self-organizing intrinsic dynamics pretty much ran the show. Later, your newly discovered ability to direct it intentionally was mostly exploratory. But its influence rapidly flourished as you began intentionally directing your coordinated action in the world. Soon, your agency, or intentionally directed intrinsic dynamics, became your rudimentary self-awareness. You became *you*. This directed, voluntary, purposeful, willed, intentional action—is your “agency directing intrinsic dynamics towards ends”, though you probably don’t think about it that way. If you don’t, you’re not alone. Most of us seldom consider the effects our intentions have on our intrinsic dynamics and *vice-versa*.

In Coordination Dynamics (CD), intentional action is proposed to emerge from the coupling between you and your world, attracting and moulding the actions of your intrinsic dynamics toward desired ends. Your intrinsic dynamics dictates the influence intentions can have. At the same time, your intentions can stabilize and destabilize your intrinsic dynamics in the direction of your intentional action. Intentions both constrain and are constrained by intrinsic dynamics. CD captures the complementary nature of intention and intrinsic dynamics. It shows what intentions do and how they do it: how *intentions* are constrained by the stability of your intrinsic dynamics and how the latter influences which actions actually occur and how fast you can switch flexibly and adaptively between them.

Think about breathing. Breathing is vital and complex, physically, mentally, and spiritually speaking. From a CD perspective, breathing is a directable, spontaneous self-organized pattern of inspiration and expiration. Up to a point, you can hold your breath. Directing your breath, like when you eat or speak, is intentional action constrained by the intrinsic dynamics it intends to modify. When you stop directing it, spontaneous breathing takes over again. Your *squiggle sense* also has intrinsic dynamics. And if you know about it, you can wield it, direct it towards sensing the complementary nature. If you aren’t aware of, or ignore it, its spontaneous, self-organizing, metastable intrinsic dynamics takes over again. Your new awareness of the *squiggle sense* and ability to intentionally direct it is still mostly exploratory. But its influence can rapidly grow and develop. When the intentional, agency-directed intrinsic dynamics of your *squiggle sense* becomes routine, you’ve become a Metastabilian!



The Metastabilian says: Intending to engage the *squiggle sense* of my metastable brain~mind, I do karma: I act by way of my body, speech and intellect. My intentional action influences the intrinsic dynamics of my *squiggle sense* as its intrinsic dynamics influences my intentional action to engage it. These are complementary aspects of my agency. They *squiggle*. And to what end are they directed? To sense and act upon the very complementary nature from which they have emerged!

Related squiggles: voluntary~automatic, purposeful~spontaneous, conscious~unconscious...

16 Of Perception and Action



The firing pattern of both mirror and canonical neurons in area F5 shows clearly that perception and action are not separated in the brain. They are simply two sides of the same coin, inextricably linked to each other—Marco Iacoboni

Perception and action are essential complementary aspects of life. Without your ability to perceive, you could never have discovered your spontaneous, self-organized intrinsic dynamics in the first place. Your agency, sentience, or self-awareness could not have emerged. Without action, you would have had neither ways nor means to respond to and modify your perception, no way to direct your intrinsic dynamics towards ends. Your agency would have had no way to develop, function, adapt and evolve. The complementary nature of perception~action is the foundation of human intelligence, a complementary dance of your body and brain~mind directed and driven by the very perception~action processes they engender.

Perception and action are neither separable nor dualistic. They are two sides of the same coin—dynamically coexistent, mutually related and inextricably linked. They constitute complementary aspects of one of the principal *squiggles* of The Complementary Code of CD. Perception~action arises from the on-going emergent coupling of your body~mind with your world and requires *active sensing* (seeing, hearing, tasting, touching, smelling...). Perception~action of your *squiggle sense* of the complementary nature requires your brain~mind to enter its metastable mode.

Strong hints of metastable brain~mind come from studies of the perception~action dynamics of ‘ambiguous figures’, where a constant image is perceived to spontaneously switch back and forth between two interpretations. In experiments, switching times of perceived ambiguous stimuli are hypothesized to be generated by an underlying intermittent, metastable neural mechanism. This suggests at least one way your brain~mind flexibly enters and exits coherent brain patterns and avoids getting trapped in mode-locked states. These unusual situations of ambiguous stimuli (often referred to as illusions) hint strongly that your *squiggle sense* is active even if you aren’t intentionally directing it. They help to make you aware that life presents you with uncountable uncertain, often ambiguous situations. You also know how easy it is to get stuck in a single mindset. Engaging your *squiggle sense* can alter your perspective of the many fuzzy, ambiguous situations that occur in life, providing you an entirely novel point of view. Know this for sure: there’s nothing ambiguous or uncertain about the *squiggle sense* or the Metastabilian who wields it!



The Metastabilian says: To understand perception-action, or any *squiggle*, I must not only discover facts, draw logical inferences and construct theories, but also consider different points of view. My metastable mode is a way of thinking or understanding that sees beyond the data given. It's not only about intentional looking. In many situations in life, although nothing may change input wise, what you perceive depends on your perspective, on how you see it. Whereas Gestalt (organization-transformation) and ecological (affordance-effectivity) explanations are related and relevant, my metastable mode transcends theories of perception. It's not just about percepts and perceptual change. It's more about “seeing” things, the sixth sense of the poet-scientist—the *squiggle sense* of perception-action.

Related squiggles: sensing~moving, affordance~effectivity, information~meaning...

17 Of Intrinsic Dynamics and Functional Information



It is not the strongest of the species that survives, not the most intelligent that survives. It is the one that is the most adaptable to change—Charles Darwin

Consider the self-organizing, intrinsic coordination dynamics of your body~mind. You first perceived your body as an infant, discovering you could direct it as your agency and self-awareness emerged. And you have directed it ever since. But now as ever, to survive and thrive, your awareness must interact with and relate to the world. For this, you depend on your body~mind to perceive movement, space, surfaces, textures, weight, sounds, smells, temperature, time, the phases of the moon—all of which inform your awareness. You use this information to know what's going on, to guide, navigate, and coordinate your intrinsic dynamics (ID) with the world. In Coordination Dynamics (CD), such useful, meaningful information that you use to enhance your ability to adapt and change—ultimately your fitness for survival—is called functional information (FI).

Of course, the ocean of information zipping around the internet demonstrates the extent to which humanity has become inundated, dependent, even addicted to “information”. But is all that information functional? Not likely. Whether information is useful and meaningful obviously depends. What is meaningful to one person or creature can be meaningless to another. The scale of the organism, its capacities, stage of development, knowledge, skill level, etc. all affect whether information is meaningful or not. Can your *squiggle sense* help you survive and thrive in the face of uncertainty? It's very likely! In CD, functional information is meaningful and specific to your intrinsic dynamics, which depend on the range, scope and context of all the different activities you perform, like when you communicate, drive, eat, speak, read, adapt, learn, and remember... “If it doesn't affect your ID, it isn't FI.”

And there it is: intrinsic dynamics and functional information are complementary. They are a *squiggle*. Functional information lies in the coupling between you and your surrounding environment. Once created, it can stabilize and destabilize dynamic patterns of behavior. Internal and external conditions often have to be just right for functional information to express itself. FI not only modifies your existing intrinsic dynamics but its effects are tempered by them in a kind of circularly causal way. Context is crucial. What is meaningful in one situation or scenario may be meaningless in another. Your engaged *squiggle sense* allows you to perceive the complementary nature. If the words you are now reading enhance that ability, they can be considered a source of functional information that has altered the intrinsic dynamics of your *squiggle sense*!



Only intrinsic dynamics, only functional information, either intrinsic dynamics or functional information, both intrinsic dynamics and functional information, intrinsic dynamics changing to functional information, functional information changing to intrinsic dynamics, between intrinsic dynamics and functional information, neither intrinsic dynamics nor functional information, beyond intrinsic dynamic and functional information...

The Metastabilian says: Now as I embrace the complementary nature of functional information~intrinsic dynamics, I begin to appreciate the profound advantages and benefits of the awakened *squiggle sense* of my metastable mode. Functional information influences the intrinsic coordination patterns of life in every boundary~domain—evolutionary, developmental, learning, social, economic, cultural, public, personal and private. It provides new meaning and utility, new perspectives to enjoy and explore, to experience the awe-inspiring mystery and wonder of the grand coordination of the complementary nature, and the miracle of my *squiggle* sentience! It allows me to be much more adaptable. It allows me to survive.

Related squiggles: talent~training, nature~nurture, innate~learned...

18 Of Learning and Memory

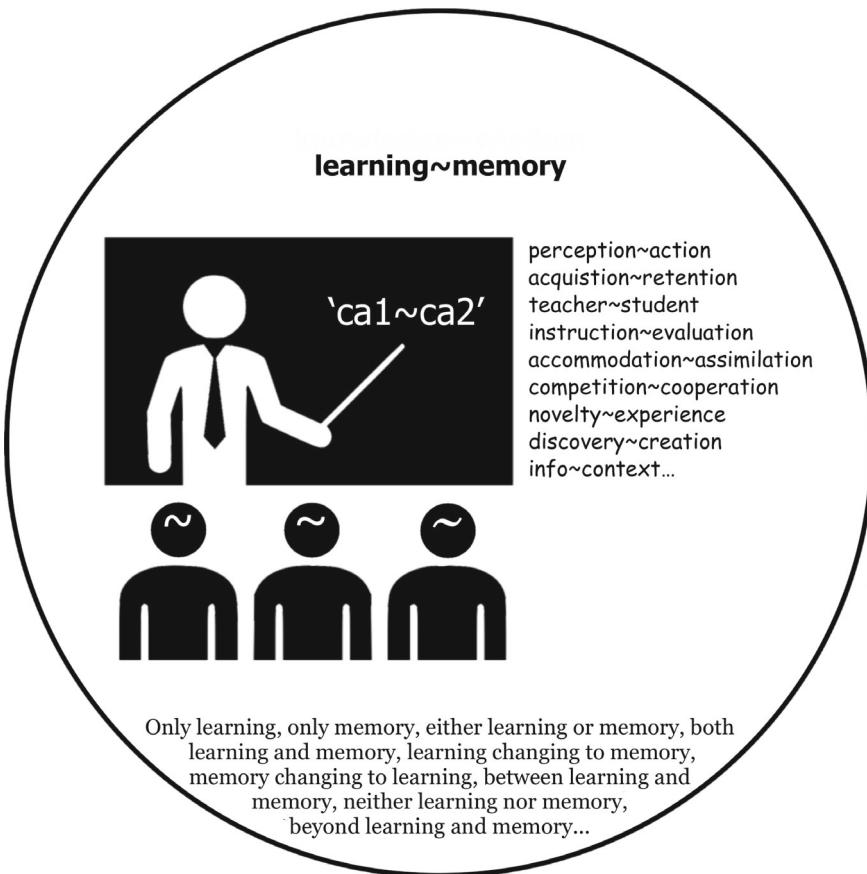


The biggest mistake of past centuries in teaching has been to treat all students as if they were variants of the same individual and thus to feel justified in teaching them all the same subjects the same way—Howard Gardner

The *squiggle sense* is a key to a virtually untapped potential within you to enhance your ability to learn, remember, adapt and evolve. In Coordination Dynamics (CD), memory refers to the dynamic stabilization of what is learned. The process of stabilization of learned information occurs on many timescales, as in short and long term memory. Memory also takes many forms, like implicit and explicit, recognition and recall, declarative and procedural, and occurs on many levels, from the synapses that connect neurons to the collective memory of entire cultures. How it's done remains a great, unsolved scientific mystery. In CD, memory, the “lasting effect of learning and adaptive processes”, is recast as “persisting modifications of intrinsic dynamics~functional information.” This is useful. It suggests how learning~memory happens: information becomes functional when it modifies your intrinsic dynamics just as your intrinsic dynamics constrain, shape and modify new information to be learned.

So how successful learning and memory formation are depends both on your intrinsic dynamics and the efficacy of the information that modifies it. Like all human beings, your intrinsic dynamics is unique and ever evolving. CD research verifies the idea that people learn and remember in their own way. So how do you teach the same subject to a collection of different students? The usual educational strategy is to treat all learners as if they were variants of the same model individual, and to teach all subjects the same way. Though arguably expedient from an institutional perspective, it's often found to be less than efficacious. A contrary approach is to treat learners individually, teaching the *same* subjects different ways, according to the way a learner learns.

This sounds good, but it's easier said than done. A major challenge is that it takes time, effort, resources and means to implement it. How might one survey the intrinsic dynamics of all students, and adjust the learning material accordingly? You might have caught the *squiggle* irony here: “two contrary strategies for learning...” Doesn't that suggest a reconciliation is in order? In practice (and many effective teachers are aware of this), tolerance and incorporation of both teaching strategies is predicted to be the most effective. Such an approach follows learning~memory's grounding in CD: It says your *squiggle sense* of the complementary nature is engaged at the core nexus of learning~memory, in your brain~mind's metastable mode, where functional information is created~destroyed. Could strategies to foster the *squiggle sense* of learners be the key to a long awaited, evolutionary advance in education?



The Metastabilian says: And once again, I marvel at my *squiggle sense* of the complementary nature, at its grand coordination—how all my thoughts, plans and realizations, my coordinated decisions and actions mix in the metastable mode of my brain~mind! They cooperate~compete, modify and are modified by functional information~intrinsic dynamics. Such modifications change me and I them—my agency driven self-organization, my evolutionary trajectory, the mystery~wonder of my individual~collective learning~memory, whose persistence and change carry me through the vast, fleeting, shimmering dynamical landscape of metastable CD!

Related squiggles: acquisition~retention, novelty~experience, accommodation~assimilation...

19 Of Individual and Collective

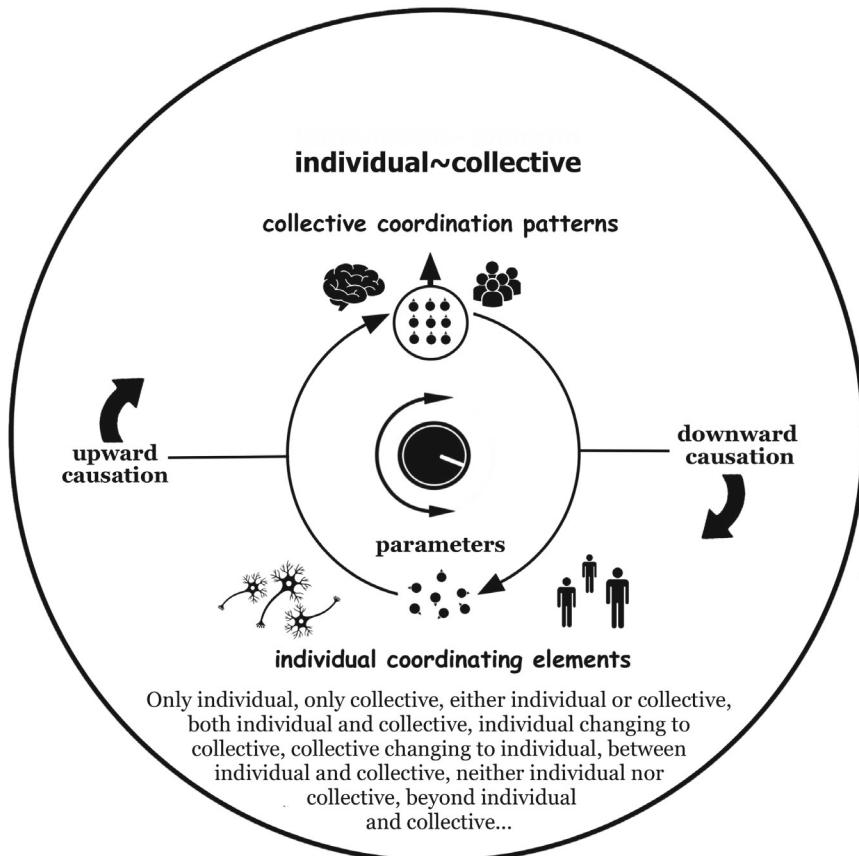


Synergy is the only word in our language that means behavior of whole systems unpredicted by the separately observed behaviors of any of the system's separate parts or any subassembly of the system's parts—R. Buckminster Fuller

At this time, humanity is a collective of about 8 billion human individuals, of which you are one. You're also a collective of around 37 trillion individual cells, coordinated in the dance of your life—a spontaneous, self-organized intrinsic dynamics acting on many space and timescales. Such staggering complexity is next to impossible to comprehend. Or is it? The roles of individual and collective in the context of life's complexity have been incessantly debated throughout history. Most often, one or the other is deemed more fundamental. Your *squiggle sense* can help you transcend such debates as you perceive individual and collective to be complementary aspects, and coordination dynamics (CD) to be the key to understanding their complementary nature. In fact, all of the complex systems studied by CD deal with individual~collectives, dynamic, self-organized collectives of individual coordinating elements or synergies. Every individual~collective is a synergy and vice versa.

You may know that 'synergy' means the combined effects of a whole, collective system that can't be predicted by separately observing only its individual parts. In viable complex systems, synergies are adaptive structural~functional entities that are the target of developmental, learning and evolutionary processes. But where do synergies come from, how are they formed and what functions do they serve? CD explains how individual~collective synergies arise, how they work and what they can do. Together with the rest of the *squiggles* of its complementary code, individual~collectives, or synergies, are crucial to comprehending the complexity of your own awareness, your collective~individual intrinsic dynamics, the synergy of your complementary brain~mind and its *squiggle sense*!

The complementary nature of synergies means that collective wholes and their individual parts are dynamic, coexistent and mutually entailed. Individual coordinating elements are only individual if they can retain some degree of autonomy while constrained by a collective whole. Collective wholes entail dynamic constraints that serve to couple individual coordinating elements together, thereby affecting how those individuals behave. A key discovery of CD is that in a complex system's metastable mode, tendencies for individual expression coexist simultaneously with tendencies for individuals to coordinate themselves as a collective. Many of humanity's problems and conflicts can be usefully addressed by appreciating the *squiggle sense*—the cooperative~competitive, complementary nature of individual~collectives.



The Metastabilian says: How can I reconcile this ultimate complexity, this ‘Grand Coordination’, this cosmic individual~collective, synergy of synergies where a part is a whole and a whole is a part, dynamically speaking, together~apart? My *squiggle sense* is the key. While it is engaged, my brain-mind is in its metastable mode and my sixth sense of the complementary nature is awake and active. I am the individual~collective reconciliation, and directly experience the behavior of the whole unpredicted by the behavior of the parts. In those fleeting moments, I am the one in the many and the many in the one!

Related squiggles: one~many, part~whole, component~system, top-down~bottom-up...

20 Of Dissipation and Cycles

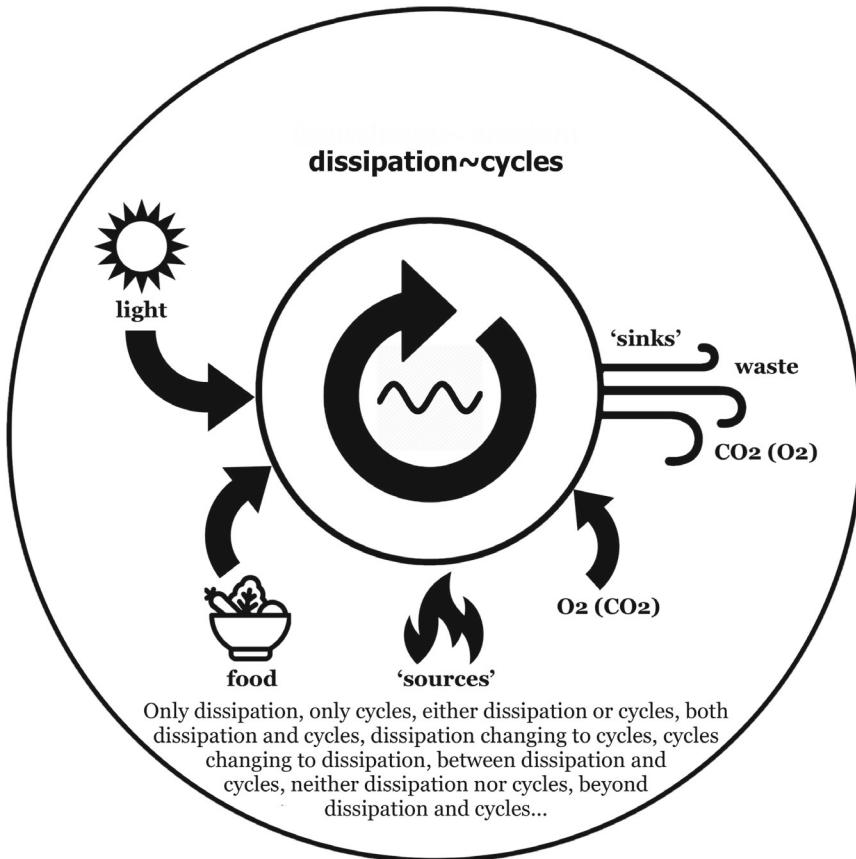


Energy that flows through a system acts to organize that system—Harold Morowitz

Your *squiggle sense* is a way to grasp and appreciate your self-organizing intrinsic dynamics, your individual~collective synergy of synergies. It's the grounded *squiggles* of the complementary code of Coordination Dynamics (CD) that enables a deep connection to the complementary nature. At the heart of those vital *squiggles* chugs the complementary aspects of dissipation and cycles. Realize that CD refers to dissipative, open, nonequilibrium systems, just like you and all living creatures. Energy, matter and information from the environment flow into such systems as “sources” acting to organize them, and energy and waste flows out of them from “sinks” (sources~sinks).

Consider the fact that you breathe in air and eat food (sources). Your body uses the energy and materials to sustain your self-organized biological integrity, your intrinsic dynamics. Meanwhile, you eliminate CO₂, waste and heat (sinks). Similarly, plants absorb incident light and CO₂ (sources), and eliminate oxygen and heat (sinks). Only dissipative systems are capable of producing and sustaining the self-organized dynamic patterns~pattern dynamics of individual~collective synergies. But how is dissipative energy flux inextricably linked to life’s cycles? Well, it creates them! Morowitz’s Theorem from the field of biophysics says that in systems “in a non-equilibrium steady state, the flow of energy from a source to a sink creates a cycle.” This is what Morowitz meant when he said, “energy that flows through a system acts to organize it”.

Cycles are the archetypes of time-dependent behavior of all living things at all scales from cells to economies—all produced and sustained via dissipative energy flux. The dynamic functions and structures of life like glycolysis, DNA and proteins, cells, organs, organisms and their behavior are all inherently cyclical. They cycle with different characteristic periods on many timescales, from nanoseconds to years, contributing to the wide variety of rhythmic behaviors observed in organisms. CD views the brain itself as a ‘geography of improvised rhythms’ that resonate with the world. Without source~sinks and energy dissipation, there are no cycles. And without cycles, there is no coordination, no possibility of sustained life. But notice, Morowitz’s Theorem doesn’t tell you how cycles are actually produced, how they self-organize, or how the many different cycles on different levels of a dissipative system become synergistically coordinated. For that, you need to learn about the rest of the complementary code of CD.



The Metastabilian says: I am a dissipative, open, nonequilibrium system. Energy courses through me. I breathe and eat, which introduces oxygen and food that stoke my inner living fire, and I give off heat, waste and CO_2 . Energy, matter and information fuel my spontaneous, self-organizing intrinsic dynamics, the dynamic patterns~pattern dynamics of my complementary nature. And through dissipation~cycles, I sustain my body~mind, brain~mind...and *squiggle sense!*

Related squiggles: energy~matter, open~closed, entropy~order...

21 Of Boundary and Domain

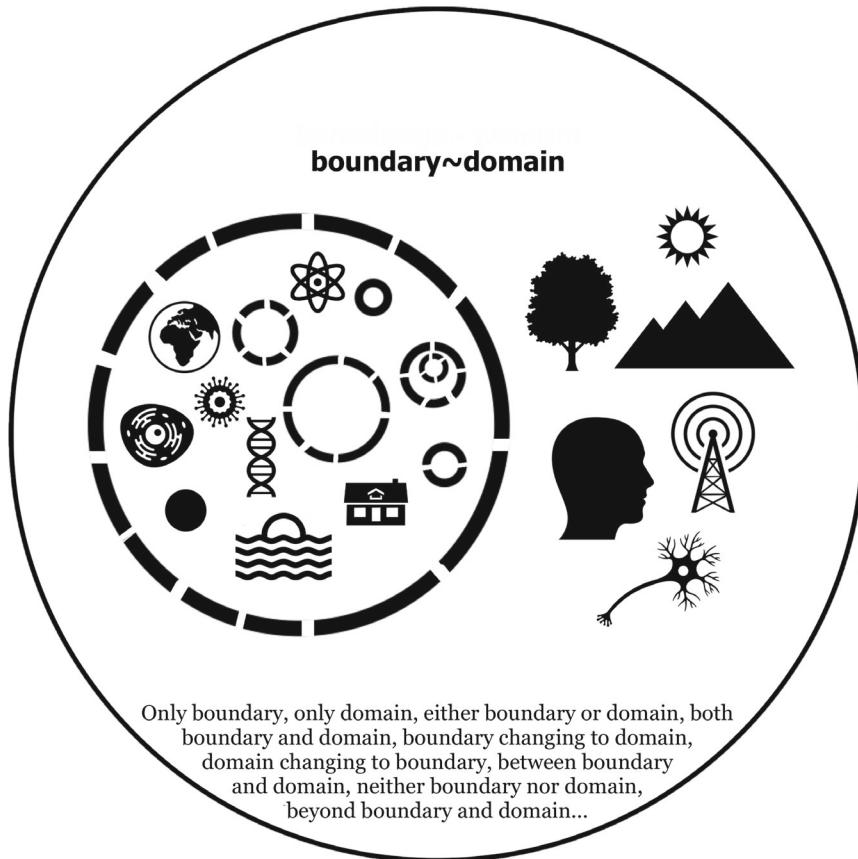


The world is a nested space, and so we have our brain as a person, and people are members of teams, and teams are part of business units, and business units are parts of corporations, and corporations are part of industries, which are part of economies—
Clayton Christensen

In the complementary nature, levels are relative to each other. No single level has priority. This perspective is reified in Coordination Dynamics (CD), where it inspires the ongoing search for level-independent mechanisms and principles. The theory, model and experiments of Coordination Dynamics indicate that levels are synergistic individual~collectives. They are dynamic, inextricably linked, complementary and relative: What is micro at one level is macro at another. What is local at one level is global at another. But levels of what? What is a level? From the perspective of your *squiggle sense* grounded in Coordination Dynamics, there isn't one fundamental level of reality. A level is a dynamic, individual~collective boundary~domain, a dissipative, self-organized, nested container.

The earth is an example of a dynamic boundary~domain at the planetary level. And nested within its viable biosphere, are multitudinous boundary~domains, which include human beings and their many different social, biological, cultural and psychological levels. Each of these is also a dynamic boundary~domain, none of them have ultimate fundamental priority either! You are an individual~collective boundary~domain at the human level. Within your personal domain are the innumerable, coordinated, nested boundary~domains of your being: your brain, organs, muscles, cells, nuclei, DNA, etc. So it is and so it goes, all the way up~down, within~between, side-to-side, round and round...

Whereas no level of the complementary nature is fundamental, each boundary~domain is unique. They're different from each other, all are in flux, and coordinate with each other in different ways. It's bewildering to imagine how levels can be inextricable, equally valid and complementary. Yet in Coordination Dynamics, universal coordination laws do exist between~within individual~collective boundary~domains of living things. Coordination Dynamics even reconciles the *squiggle* dance of level-independent and level-dependent dynamical mechanisms and principles. A good way to grasp the perplexing complementary nature of boundary~domains is to just imagine the *squiggle* dance of any boundary and domain you're interested in. Whenever you do that, you engage the metastable mode of your brain~mind, which awakens your *squiggle sense*. Use your *squiggle sense* to extend the boundary~domain of your brain~mind!



The Metastabilian says: What does it mean that there is no ultimate top and bottom levels, but rather an endless chain of nested, equally valid levels? It means that reductionistic ‘bottom-up’ and holistic ‘top-down’ thinking, explorations and explanations in their own right are eventually limited and limiting, and should be reconciled. To do this, I engage my *squiggle sense* of levels, of boundary~domains. Through it, I appreciate that to truly grasp any boundary~domain I must study its behavior and boundary features, its interaction with other boundary~domains, those nested within it, and those within which it is nested...

Related squiggles: between~within, organism~environment, global~local...

22 Of Spatial and Temporal

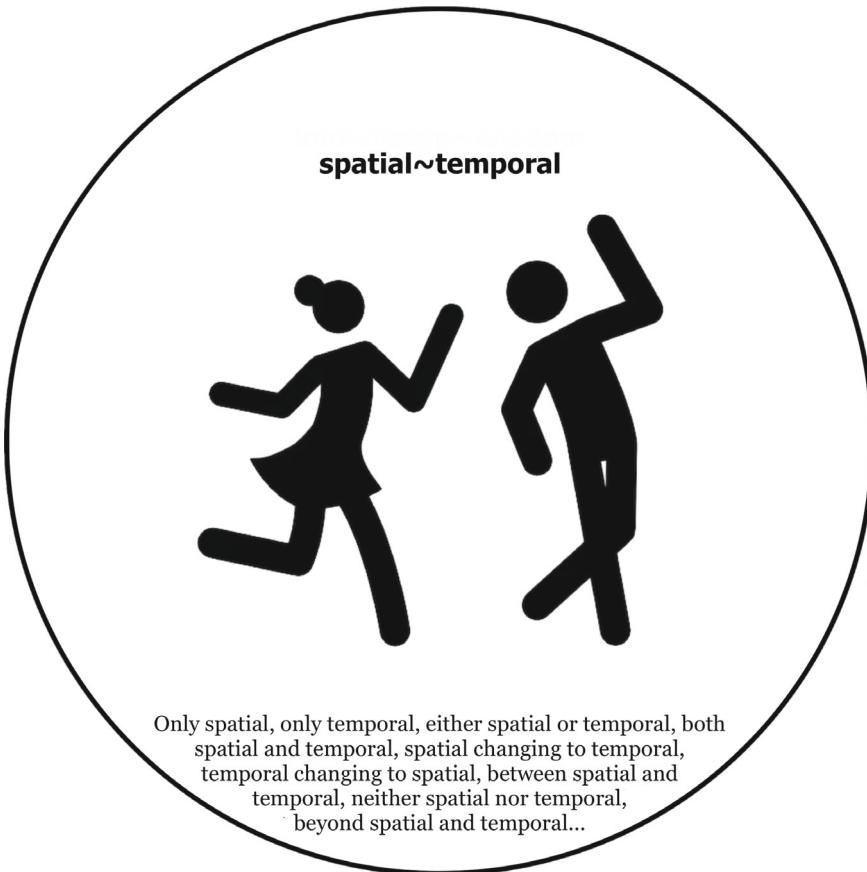


The dance is the mother of the arts. Music and poetry exist in time; painting and architecture in space. But the dance lives at once in time and space—Curt Sachs

You are a spatial-temporal being, a *squiggle* dancer-dancing that lives at once in space and time. Spatial refers to that which occupies or surrounds space—often described by terms like size, position, shape, length, area, volume, geometry. It's the ‘what’ and ‘where’ of reality. Temporal means ‘of time’, contained in words like epoch, movement, rhythm, cadence, sequence, process, event, duration. It's when things happen and how long they last in the dynamic flow of reality. In the language of Coordination Dynamics (CD), spatial and temporal can't be meaningfully separated. They are a *squiggle*—inextricable, dynamic, complementary aspects of reality. The dance of life, like information, motion and energy, lives at once in time and space!

The complementary nature of your spatial-temporal existence includes all that you are and do. Ironically, until about a century ago, space and time were widely considered to be separate aspects of reality. That view was forever changed due to the profound thought, mathematics and science of Henri Poincaré, Hermann Minkowski, Albert Einstein and others. The theory of Relativity that radically changed humanity's understanding of the cosmos depends upon the idea that space and time are not separate. Yet, Relativity, amazing and useful as it is, is so far removed from your everyday life that it's easy to ignore it. On the other hand, the dynamic, complementary spatial-temporal coordination of your own body-mind, the dissipative synergies that are you and that enable your dance of life with others and the world around you are as close and relevant as can be.

So how can your *squiggle sense* and Coordination Dynamics help you grasp and appreciate the complementary nature of your spatial-temporal coordination? Well, to begin with, your *squiggle sense* is a spatial-temporal sense. That's its function. When engaged, that is, when you are in your metastable mode, your perception-action is spatial-temporal! And how spatial-temporal coordination works is exactly what Coordination Dynamics is about. It's a science of functional spatial-temporal synergies that evolve in the ‘phase space’ of informationally relevant coordination variables. By engaging your *squiggle sense*, you can learn the complementary code of Coordination Dynamics. The spatial-temporal dance of each squiggle contributes to the collective squiggle dance of Coordination Dynamics itself—the Coordination Dynamics of the complementary nature!



Only spatial, only temporal, either spatial or temporal, both spatial and temporal, spatial changing to temporal, temporal changing to spatial, between spatial and temporal, neither spatial nor temporal, beyond spatial and temporal...

The Metastabilian says: I am a spatial-temporal being, a squiggle dancer-dancing, as are each of the synergies that define my individual-collective complementary nature. And my *squiggle sense* is a spatial-temporal sense. It helps me realize that, as in the cosmology of gravity-radiation, my own spatial-temporal aspects are inextricable, dynamic and complementary. Isn't this realization as exciting and profound as light bending around a star, an event horizon of a black hole? Could the secret reconciliation of Quantum Mechanics (QM) and how CD views perception-action and the human brain-mind be hiding in plain sight, staring at me whenever I look into a mirror?

Related squiggles: space-time, what-when, structure-function...

23 Of Persistence and Change

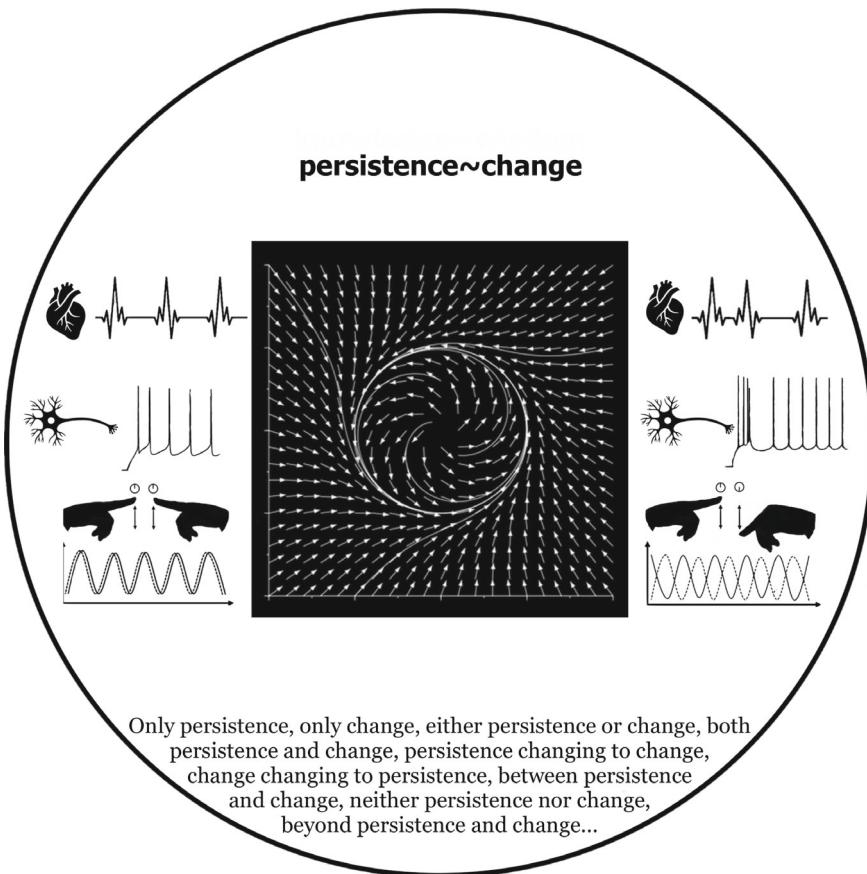


So do flux and reflux—the rhythm of change—alternate and persist in everything under the sky —Thomas Hardy

The complementary nature of persistence and change, the essence of what it means to be dynamic, is a generic, indispensable, vital feature of reality, of your existence and awareness. From the perspective of the *squiggle sense*, the old sayings, “the more things change, the more they stay the same” and “nothing lasts forever” are equally valid and complementary. Persistence~change is such a fundamental *squiggle* that it’s easy to overlook and take for granted. But can its complementary nature really be discovered, explored and understood? Actually, yes it can. Coordination Dynamics (CD), a theory of directed self-organization, offers deep insights into the *squiggle sense* of persistence~change. CD shows how the flux of energy (change) through a complex living system like you plays an active role in self-organizing the dynamic patterns (persistences) you compose and that compose you. The stability (persistence) of those dynamic patterns is maintained at the price of energy dissipation (change). No energy flux (fuel), no dynamic patterns...no *you*.

The basic building blocks of CD are individual~collectives called synergies. Synergies are dynamic clusters of elements or processes that are sufficiently self-organized to produce persistent functions, like the cells of your heart, brain, lungs, muscles and gut. Hallmark features of synergies are both their stability and their flexibility. Whereas some variables cause a synergy to change, others preserve the integrity of the synergy to persist, to resist change. But how? Such deep questions regarding the complementary nature of persistence~change are precisely those pursued in CD! Grasping the CD of spatial~temporal persistence~change begins with the ubiquitous phenomena of oscillation and cycles, of flux and reflux.

Oscillation is a ubiquitous property of all natural behavior. Spatial~temporal dynamical patterns, including the very long lasting ones we call ‘structures’, are inherently cyclical. For any process to persist, a cycle of work must be done. It’s the flux of energy from sources to sinks that fuels such cycles. The engines of persistence~change sustain cyclical motion by absorbing over the course of each cycle an amount of free energy that nearly balances the energy dissipated per cycle. Without this energy balance, things would simply decay toward static equilibrium. In CD, the main dynamical archetype that has been shown to underlie such spatial~temporal persistence~change is called the “limit cycle”. How limit cycles emerge, function and interact are at the heart of CD and the complementary nature of persistence~change.



The Metastabilian says: Persistence-change underlies all the dynamic patterns of my life, the being-becoming of my body-mind, my action-perception, all the relevant spatial-temporal rhythms of my existence. Learning and appreciating CD enables my *squiggle sense* to function and persist-change according to its complementary nature. CD explains how those rhythms, steady states, and limit cycles actually self-organize, which inspires me to engage it even more. What goes around, comes around!

Related squiggles: stability-instability, quiescent-active, learning-forgetting...

24 Of Convergence and Divergence

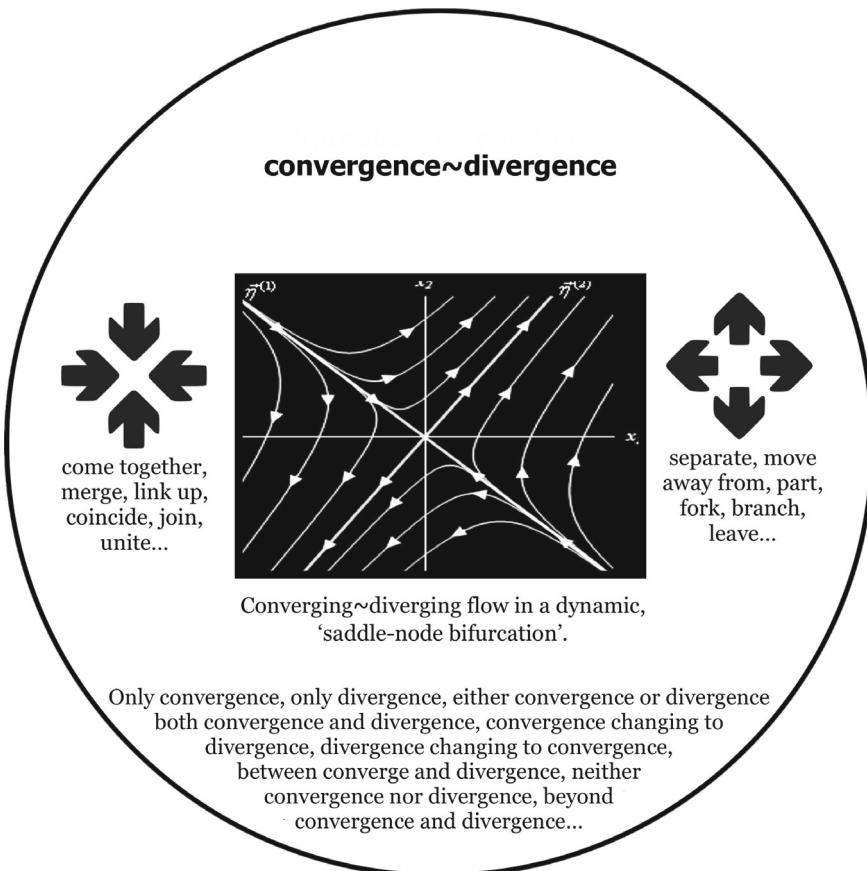


Differing from Newton and Schopenhauer, your ancestor did not think of time as absolute and uniform. He believed it an infinite series of times, in a dizzyingly growing, ever spreading network of diverging, converging and parallel times—Jorge Luis Borges

Convergence~divergence is a *squiggle* of the complementary code of Coordination Dynamics (CD) that says: “the tendency of the flow of a dynamical system to converge coexists with the tendency of its flow to diverge”. Dynamic patterns of all types, at all levels and in all contexts are literally complex dances of converging and diverging pattern dynamics. In fact, convergence~divergence is the way all matter behaves near phase transitions in physics, ‘critical points’ like freezing and boiling—where the state of matter converges and diverges from so called, ‘saddle points’. CD enables you to anticipate, perceive and respond to the converging~diverging dynamic patterns within you and surrounding you, that fill your life with meaning, and enable you to make *squiggle sense* out of them!

Now, the inextricable coexistence of convergence and divergence might seem pretty self-evident. When it does, that’s your *squiggle sense* talking. Yet in many situations and contexts, your inner voice might whisper quite the contrary, like “Forever together!”, “Never the twain shall meet again!”, “Do I stay or do I go?” Luckily, in these situations, awareness and appreciation of the complementary nature of convergence~divergence and how it fits into the CD paradigm can help you return to your metastable mode and re-engage your *squiggle sense*. A good place to begin is simply to think about how you might observe the converging~diverging dynamic patterns of a complex system...and imagine the underlying dynamics.

One way would be to watch time-lapse videos, like a person’s activity over a day or week, a drone’s-eye view of traffic, busy city-streets, a classroom, a nightclub, an artist painting from blank canvas to finish, the long term behavior of wild animals, blood flow, mitosis, etc. It’s mesmerizing and a bit comical how the coordinating elements zip around one another, in and out, back and forth, stopping and starting. It’s a thrumming rhythmicity of dynamic patterns. Observing a system in this way reveals an underlying flow, patterns of converging and diverging that aren’t nearly as apparent when viewed in the normal time frame. Coordination Dynamics has many experimental strategies that are even more revealing than time-lapse videos, though it shares with them the strategy of observing a complex system in ways that reveal dynamic patterns of coordination that are often missed or taken for granted. And it uses those critical, saddle points of convergence~divergence to help identify the underlying Coordination Dynamics.



The Metastabilian says: Driving along, I watch the motorway ahead converging, whilst simultaneously glancing into the rear-view mirror at my receding, diverging wake. At that same time I muse upon the convergence~divergence of perception~action and knowledge~wisdom of my metastable mode, the breathtaking miracles of synergy and reciprocal causality, found exactly where opposing tendencies coexist. That discovery led to CD's "Principle of Coexisting Opponent Tendencies" (COT). The dance of complementary contraries is an archetype of dynamical convergence~divergence, which happens everywhere and every when, in all systems, at all spatial~temporal levels and scales of observation. Incredible!

Related squiggles: gravitation~radiation, attracting~repelling, assembling~separating...

25 Of Multifunctionality and Functional Equivalence



If they tell me one more time that I'm using the wrong fork for a part of a meal, I swear I'll show them exactly how multifunctional the utensil can be—Jennifer Ellison

Synergies and *squiggles* of the complementary code may seem a bit peculiar to study and reconcile using the binary, either-or logic common to most scientific enquiry. Historically, physical science has predominantly pursued a reductive approach to the dizzying array of structures and functions found in nature. The assumption is that the parts will sum up to the whole. More often than not, especially in biology, rigid, linear, one-to-one structure-to-function perspectives are ill-equipped to understand and explain the complex, nonlinear dynamic phenomena typical of living systems. There, and in Coordination Dynamics (CD), the ubiquitous characteristics of multifunctionality and functional equivalence reign.

Multifunctionality is the capacity for the same dynamic structure to express multiple different functions. The best example of multifunctionality is you! Human beings are one of the top ‘Swiss army knife’ species of the animal kingdom. You use the same structures of your body and brain to perform many different functions. Even if one wanted to, it would be a major challenge to identify and count them all. Functional equivalence is the complementary aspect, namely the capacity for the same function or goal to be realized by different material structures (parts, components, brain regions, team members...). The problem of the classic approach to understanding these phenomena should be obvious: nonlinear one-to-many and many-to-one structure~function relations simply cannot be captured by linear, ‘one-to-one’ perspectives and paradigms.

On the other hand, multifunctionality and functional equivalence are inherent attributes of CD, and occur at all levels of biological organization. They are in fact hallmarks of synergies, the structural~functional units of life, those dynamic self-organizing evolving collective~individuals that provide the flexibility and adaptability on which living things depend. Multifunctionality~functional equivalence is a *squiggle* of the complementary code of CD, whose complementary nature is tied to your viability, intelligent self-organization and survival. It might even be said its very existence enables your *squiggle sense*, which in turn provides novel insights into life itself. Like all the *squiggles* of the complementary code, its behavior is grounded in multistable and metastable CD, the dynamical modes from which all *squiggles* as well as your *squiggle sense* arise.



The Metastabilian says: I'm a multifunctional being~becoming. Not only am I able to do a vast number of different tasks and functions, but I'm also able to do a given task in different ways. My body-mind and behavioral capacities are miracles of synergy, whose multifunctionality~functional equivalences transcend the boundary~domain of the current standard physical paradigm. Classical physical assumptions of mechanics and mechanisms, linearity, 1-to-1 relations between structure and function, and fixed-point models are insufficient to explain life. They must now be expanded to accommodate and assimilate the phenomena and paradigm of CD and its complementary code.

Related squiggles: adaptability~flexibility, degeneracy~equifinality, variability~redundancy...

26 Of Absolute and Relative Coordination

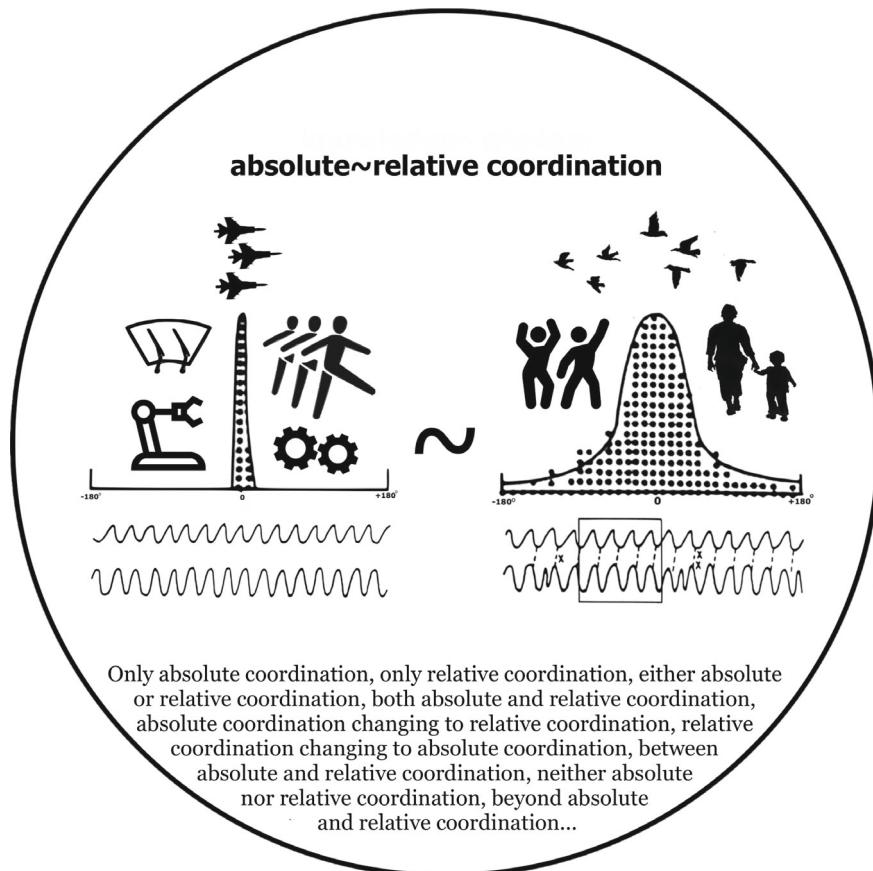


Relative coordination is a kind of neural cooperation that renders visible the operative forces of the central nervous system that would otherwise remain invisible—Erich von Holst

Whether you think about and appreciate it or not, you're an expert on coordination. It's a vital feature of your life and awareness. You know and sense coordination going on in and around you all the time with every move you make, every breath you take. Your life, life itself and the world you know would be impossible without it, let alone your ability to imagine or describe. So as an expert, think about what you know well already. Even though a total lack of coordination would be the 'end of things', there are nevertheless countless scenarios in life where dynamic elements are uncoordinated, for any number of reasons. And there are countless others that seem absolutely coordinated.

In most cases, absolute coordination is easy to recognize. It's when there's a rigid, unchanging relationship between coordinating elements, like marching soldiers, the gears, rails and pistons of machines, windshield wipers, etc.—up with up, down with down, forward with forward, backward with backward. The movements of your image in a mirror are absolutely coordinated with your movements in front of it. You would be very startled if they weren't! But if all coordination in your life were suddenly to become *absolute*, you would be even more startled. That's the stuff of Orwellian nightmares—thongs walking to work in perfect synchrony to identical factories, clone children emerging from houses at the exact same moment, bouncing balls at exactly the same frequency, amplitude and phase. In reality, total absolute coordination is untenable. Life is not an absolutely coordinated machine!

Whereas some coordination of viable living systems may seem absolutely coordinated, at least temporarily, more often it's really something in-between the extremes of absolute and no coordination. There has to be a more flexible form of coordination that allows for adaptation and variability. The brilliant physiologist Erich von Holst coined the term relative coordination to describe it. Absolute and relative coordination are complementary aspects whose complementary nature lies at the very heart of Coordination Dynamics (CD). In fact, the study of how both these forms of coordination work and how they *squiggle* was central to the development of CD. They turned out to be biological expressions of the multistable and metastable modes of Coordination Dynamics—and your *squiggle sense*. In this absolute~relative *squiggle* lies a key to how the complementary nature is connected to dynamic coordination patterns, their pattern dynamics, and *vice-versa*.



The Metastabilian says: It's funny how I control the coordinated movements of my body-mind in the complementary nature, yet the coordinated movements of my body-mind and the world are controlled by the laws of that complementary nature! I know that most of the time my coordinated movements are not absolute, not robotic, not rigid like marching soldiers, pistons and gears of machines. And yet, I can march like that at least for awhile. On the other hand, my movements aren't random, even in the moments I might wish them to be. Whatever this other, 'in-between' coordination is, my *squiggle sense* tells me it also springs from the complementary nature. And now, I marvel at how one science is able to explain all of these different scenarios with a single paradigm—Coordination Dynamics!

Related squiggles: rigid~flexible, states~tendencies, troops~flocks...

27 Of Synchronization and Syncopation

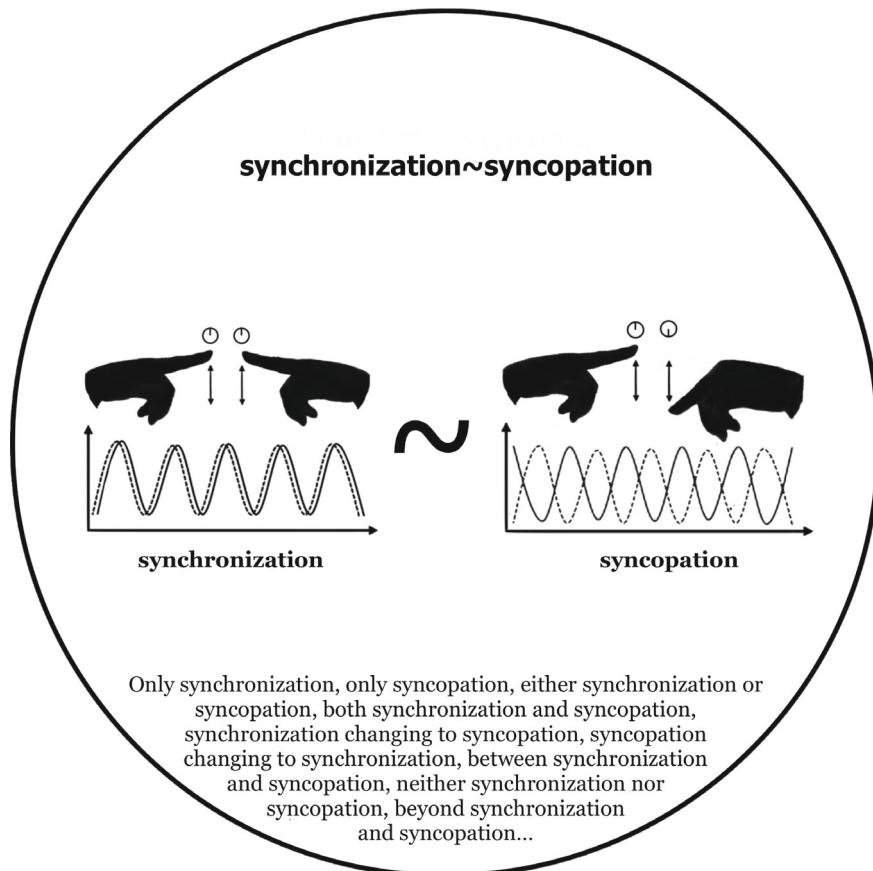


By rolling a ball down an inclined plane, we came to know how the planets move. By knowing how two fingers are coordinated we came to know how living things are coordinated—J. A. Scott Kelso

The original quest to understand absolute and relative coordination that evolved into the burgeoning field of Coordination Dynamics (CD) came long before any connection to the complementary nature and the *squiggle sense* were discovered and appreciated. The original experiments explored the coordination of voluntary rhythmic movements of the two hands. Synchronization and syncopation are basic dynamic patterns of such coordinated movement. They've been the subject of hundreds of studies, resulting in many hypotheses and theories about how they're produced. A unique contribution of CD is that it established a fundamental and lawful connection between synchronization and syncopation as two basic modes of coordination we all have. This is a crucial insight: the law not only explains how the coordination of the interacting elements produces these two dynamic patterns, but how they're connected to one another!

In the original experiments on voluntary finger movements, test subjects try to move their index fingers back and forth to a metronome in one of two ways: both fingers synchronized (both up, both down), or both fingers syncopated (one up, the other down). It turns out that these are the only way people wiggle their fingers—at least without a lot of practice. In a given experimental run, the metronome is systematically increased or decreased from an initial starting frequency, speeding up or slowing down every few seconds in small steps. This simple experiment and its many progeny have established, among many other insights, that only two stable coordination patterns exist between the fingers of both hands—synchronized (in phase) and syncopated (anti-phase). Which pattern is observed depends on the initial conditions.

Now, the usual scientific interpretation regarding two qualitatively different behavioral patterns would be that two different mechanisms are responsible. But enticingly, the results and the theory showed that's not the case. At a critical frequency, spontaneous transitions from syncopated to synchronized movements occur. Beyond the transition point, only synchronization is observed. When frequency is reduced, test subjects don't spontaneously return to where they started, a basic form of memory called hysteresis. And they don't switch at all when they start in the synchronized, in phase mode. In hindsight, these seminal observations were the first bits of evidence pointing to the complementary nature of CD! But first, the connection between absolute and relative coordination had to be realized, which required a deeper understanding of the observed phenomena and what they actually mean. This in turn meant new conceptual and theoretical development. And that has led to right here, right now!



The Metastabilian says: Synchronization is to move together in space~time. But so is syncopation, just 180° out of phase. I can do both with my finger dances, using the same fingers, muscles, nerves, etc. All the physical anatomy and physiology remains the same. Only the coordination patterns are different. Mysterious! Of course, in most cases, I'm able to change with ease from one to the other, though that depends on how fast I'm moving. And sometimes I just switch from one to another when I wasn't even trying to change... What's up with that? My *squiggle sense* whispers the answer to me—its the complementary *squiggle* dance of synchronization~syncopation.

Related squiggles: inphase~antiphase, in sync~out of sync, agreement~debate...

28 Of Synergies and Phasing

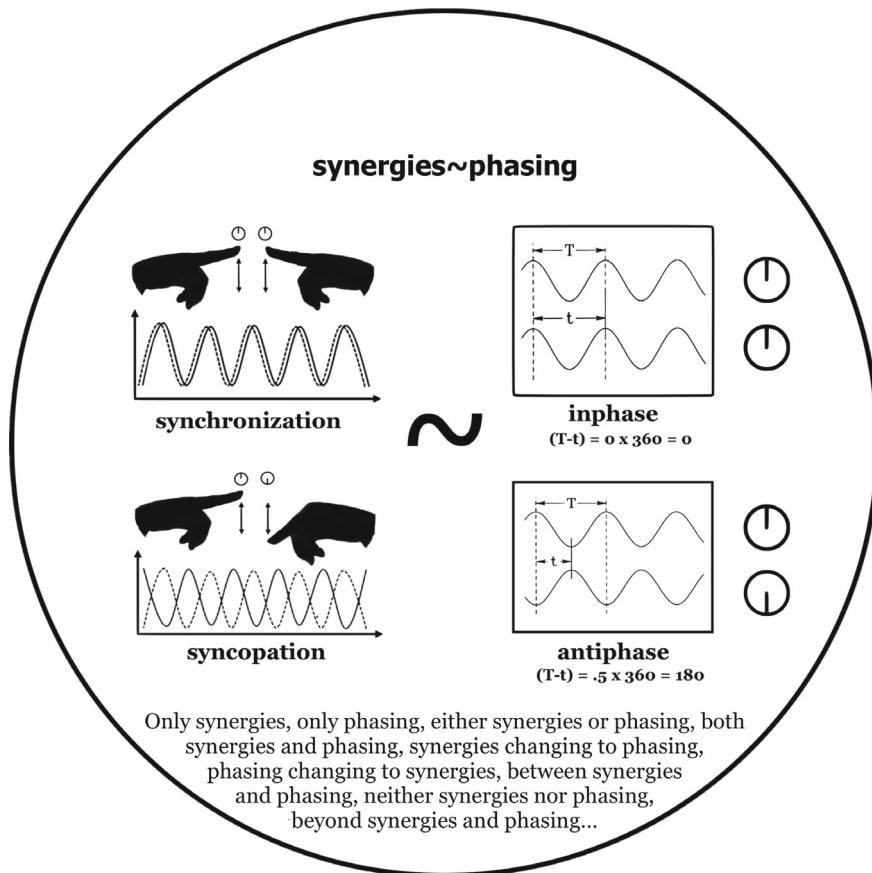


Synergies ... in which very few controls can manipulate a much larger number of configurational degrees of freedom are everywhere in biology. In biology they are indicators of complexity rather than mechanisms under constraints—Robert Rosen

You are a synergy of synergies, whose agency and behavior is not predictable by observing the behaviors of any of your separate physiological parts, component elements or their subassemblies. You are not a ‘mechanism’, a machine or clock-work whose behavior is the result of adding up the way all your individual parts behave. Actually, the word synergy is provocative. It flies in the face of centuries of reductionistic, mechanistic thought in philosophy and science that likens the universe and life itself to a grand machine or clockwork—orderly, knowable and predictable, Even today, this trend continues with the current quest in modern physics for a “Theory of Everything”—a single all-encompassing theoretical model of physics that can predict, explain and link together all known physical forces.

Whereas the mechanistic paradigm continues to be a powerful influence on scientific discourse, around the 1970s a new breed of ‘nonlinear’ scientist began to pursue new conceptual paths that deviated significantly from prior assumptions about physical reality. Since then, many branches and sub-disciplines of these pioneering efforts have emerged that are now bundled under the rubric, ‘complexity science’. Coordination Dynamics (CD) itself is based on the mathematical tools of nonlinear dynamics and the concepts and methods of self-organizing dynamical systems called “Synergetics”. Note that “Synergetics” referred to here isn’t that of Buckminster Fuller, but rather a physical theory of self-organization in nonequilibrium systems formulated by the German theoretical physicist Hermann Haken stemming originally from his seminal work on lasers.

The CD paradigm allows synergies to be studied and modeled scientifically—how they form, persist, adapt and change. A key precursor to understanding the complementary nature of CD was to identify the relevant quantities that capture a synergy’s dynamic patterns and their pattern dynamics, their persistence~change, convergence~divergence, stability~flexibility, cooperation~competition and continuous~discrete behavior. In the synergy of synchronization~syncopation, a key quantity is called ‘relative phase’—the coherent phase difference between waves of partially coupled rhythmic movements. Synergetic behavior is phasic to the core. It is propagated, modeled and understood in the language of phase relations among interacting components. The key squiggle of synergies~phasing is thus grounded in the science of synergetic coordination, that is...CD!



The Metastabilian says: My *squiggle sense* greatly facilitates my ability to transcend habitual classical assumptions about mechanisms and linear causality of life as I embrace the nonlinear CD of synergies and phasing as an illuminating step forward down the path of my new awareness and appreciation of the complementary nature. The CD of life, sentience, complexity, and circular causality suggests that humanity's understanding of physics isn't about to be 'solved' once and for all. On the contrary, it's about to evolve and embrace animate life.

Related squiggles: inphase~antiphase, cycles~phases, parts~wholes...

29 Of Qualitative and Quantitative



Merely quantitative differences, beyond a certain point, pass into qualitative changes
—Karl Marx

Coordination dynamics (CD) provides a novel and lucid way to comprehend how qualitative and quantitative phenomena and thinking are related. Hopefully, your *squiggle sense* can already attempt to reconcile them as complementary aspects. It's common though, even in the sciences, to treat them as mutually exclusive polarized styles that have led to clichés like “it's quality rather than quantity that matters...” and “qualitative is just poor quantitative...” Although it's likely you may prefer and identify more with one or the other of these outlooks in general, you actually switch back and forth many, many times a day between qualitative and quantitative modes of perceiving, thinking and doing. It changes—sometimes it's both, sometimes it's neither. It depends. Both these apparently contrary mindsets are actually necessary for you to accurately gauge and navigate qualitative and quantitative aspects of life.

Indeed, you manage to rapidly and coherently perceive, act, react, anticipate and interact with life's numerous changing qualities and quantities, ‘24/7’, even when you dream! Usually you don't think about how you do it while you're doing it. But somehow, the *squiggle* dance of qualitative and quantitative styles of thinking reconcile and compress the complex, ongoing barrage of stimuli impinging upon you. The fruit of this compression is much simpler and normal coherent thought and action that you can use to guide the ongoing trajectory of your life. But how? A vital clue is that your body~mind, your behavior and the complementary nature itself are all grounded in CD.

It turns out that the qualitative phase transitions studied in CD reveal a great deal about how dynamic patterns of brain and behavior are self-organized. Phase transitions have been used extensively to identify state changes in complex systems, providing a crucial scientific window into the underlying dynamics involved. Phase transitions occur at ‘stability thresholds’, where quantitative changes in ‘control parameters’ lead to pattern instability and the emergence of new, qualitatively different dynamic patterns. And guess what? The complexity of a system's behavior is drastically reduced near the onset of transitions. Know it or not, you are very sensitive to phase transitions of your own brain~mind and in the world around you. You use quantitatively induced qualitative change as a way to switch your behavior and simplify the unceasing quantitative flood of input impinging upon your sensorium, enhancing your ability to survive and prosper!



The Metastabilian says: Nothing lasts forever. While qualitative and quantitative aspects of my life and awareness are stable enough to perceive and identify, they are dynamic, and subject to change. The complementary nature of qualitative~quantitative perception~action grounded in CD is indispensable for my very viability and sentience. My *squiggle sense* is my sentient, intentional perception~action based on that grounding. The more I know about the Complementary Code of CD, the better I will understand the qualitative~quantitative perception~action at the core of my reality and behavior. This is one of the many treasures to be gained in the quest of my *squiggle sense*...

Related squiggles: synthesis~analysis, one~many, perception~measurement, ...

30 Of Modeler and Model

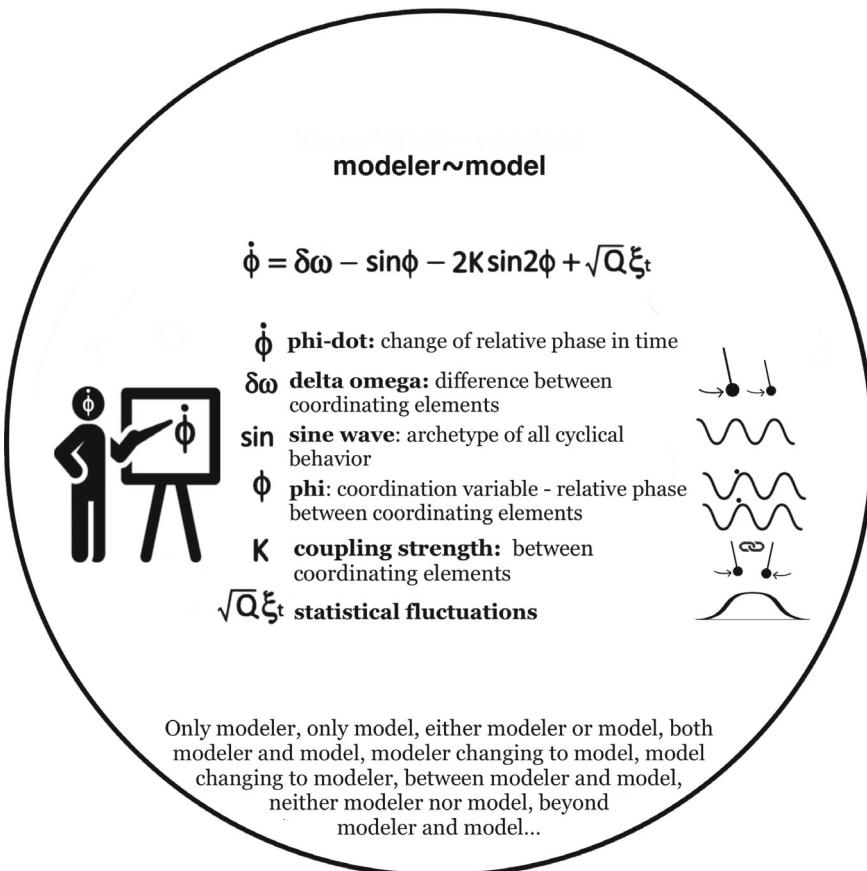


A modeler is someone who makes theoretical descriptions of systems or processes in order to understand them and be able to predict how they develop—collinsdictionary.com

The complementary nature and your *squiggle sense* are both grounded in the science of coordination dynamics (CD). This means that a significant, nontrivial connection between them has been established not only as a result of ideas, metaphors, opinions and speculation, but due to hypothesis-tested, theory-driven scientific experimentation, vetted and published in hundreds of articles in peer-reviewed scientific journals. Such a vast knowledge base can be daunting for anyone to try to grasp. To explore and comprehend it seriously, you need a way to compress all this knowledge and help you navigate it. One way of doing that in modern scientific and technological areas of research is called modeling. Scientific models often provide ‘big picture’ perspectives that can be used to explain, predict, plan and test new hypotheses. In CD, the mathematical model comes in the form of a set of nonlinearly coupled, nonlinear limit cycle oscillators called the “Extended Haken-Kelso-Bunz (HKB) Model” which, because it was tested so thoroughly, came to be called a “Coordination Law”.

The original HKB model was formulated in 1985 to account for novel experimental observations on human bimanual coordination that revealed universal features of self-organization like multistability, phase transitions and hysteresis. Since then, it’s been used to successfully model coordination in different kinds of systems and different levels of description. Many elaborations and extensions of the basic HKB model led to the discovery of general principles and mechanisms of coordination that underlie a broad spectrum of behaviors at different scales of observation: between and within moving limbs; between limb movements and tactile, visual and auditory stimuli; both spontaneous and intentional social interactions with others; between humans and digital avatars and even between humans and other species (think of horse and rider).

The Coordination Law provides insights into *you*—your agency, movement, perception, learning, *squiggle sense*, and so much more. Of course, the basic equation itself may seem less captivating and compelling if you don’t happen to be mathematically inclined. Yet it still can be revealing if you know what its symbols stand for (see illustration). Moreover, the model can be readily ‘translated’ into the *squiggles* of CD. Your *squiggle sense* can comprehend the model via *squiggles*! In the remaining *squiggle frames*, you can learn about the Coordination Law via the *squiggles* of the complementary code without the necessity of learning all the math. Still, it’s important to be aware of the model equation and the role it has played in the scientific grounding of your *squiggle sense* in CD, and seeing into the heart of CD itself!



The Metastabilian says: I'm a sentient being, a modeler. My model of the world affects my ideas, my movements, my behavior, my life. The Coordination Law of CD is a source of my model of life and also the means by which I can model at all! This general model of coordination is directly relevant to what I am and everything I do. Amazingly enough, the CD Law leads to explanations of how I can make models of my world, which I then can use to navigate, adapt, survive and evolve. And best of all, I can learn about CD via the *squiggles* of its complementary code!

Related squiggles: designer~design, theory~experiment, simulation~reality...

31 Of Coordination Variable and Control Parameter

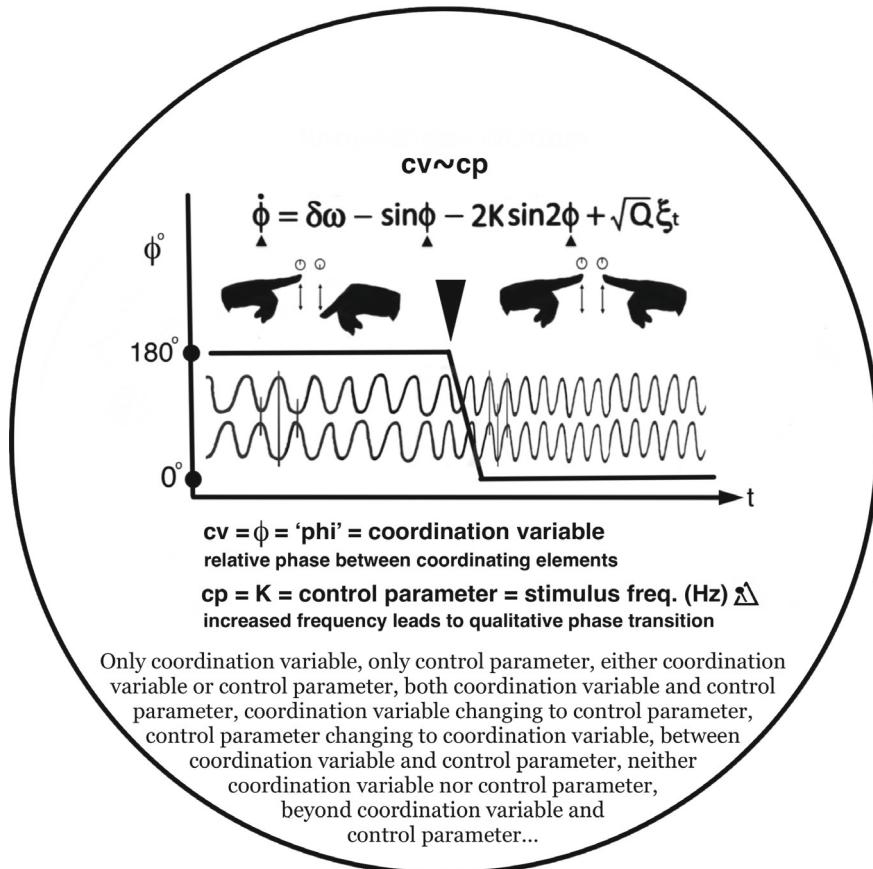


Just as Newton did not need to know anything about the sun and planets except their motions, so dynamicists in cognitive science generally provide models that stand quite independently of implementation details—Tim van Gelder

As you now begin to play the “*Squiggle Game*” to help you learn the Coordination Law via the complementary nature of its *squiggles*, appreciate that its model equation wasn’t always around, nor easy to produce. The ability to successfully capture real coordination behavior was hard won, an arduous reconciliation of theory and experiments, trial and error, observation and analysis of actual coordinating systems, like human beings coordinating movements. Happily, after all that work, it turns out that both the model and its *squiggle sense* stand quite independently of implementation details of actual systems, levels and contexts whose behavior the model captures. Indeed, the dynamics of relative phase, at the root of coordination, proves to be universal, transcending specific qualities and behavior of elements, components and processes from which it emerges.

In fact, the universality of relative phase is your entry point into the heart of the CD Law, via a foundational *squiggle* of its complementary code, coordination variable~~control parameter. In the model equation, the Greek symbol *phi* (ϕ) stands for relative phase, measured in degrees or radians. *Phi* is the equation’s coordination variable (also traditionally called ‘collective variable’ and ‘order parameter’)—Coordination: collective, ordering, self-organizing phase relationships between elements moving together; variable: *phi* varies in time—evolving, changing, the essence of coordination. Scientists studying CD measure coordination variables experimentally. Several different factors can influence them, and much research and development in CD goes in to determining what they are.

Another crucial concept is a control parameter, the generic term for any adjustable factor able to affect the on-going dynamics of coordination variables in a lawful, predictable manner. For example, in CD experiments, continuously changing frequency causes established coordination patterns to reach stability thresholds, such instability leading to qualitative changes called phase transitions. This means one coordination pattern changes, usually switching abruptly, to another. Ironically, the very existence of phase transitions resulted in *phi*’s identification as a coordination variable and conversely, movement frequency as a control parameter. Coordination variables like *phi* (ϕ), *squiggle* with control parameters like frequency. Theoretically, you can’t have one without the other. Their codefining, inextricable, complementary, (nonlinear) dynamics are at the core of CD and the complementary nature.



The Metastabilian says: The heart of coordination of my life, sentience, awareness, language, even love, springs from the lawful yet flexible and contextual universal CD of the complementary nature. This provides me a vast, novel and mostly untapped potential to know and begin to comprehend the complementary nature and my *squiggle sense*. The CD Law model equation makes it possible to study and understand the CD that grounds and expresses the complementary nature in living systems at all scales, including my own daily life. The relative phase *phi* captures the dance of coordination patterns. And control parameters lead those coordination patterns through qualitative changes—astonishingly simple yet profoundly complex!

Related squiggles: qualitative~quantitative, persist~change, stability~instability...

32 Of Heterogeneity and Coupling Strength

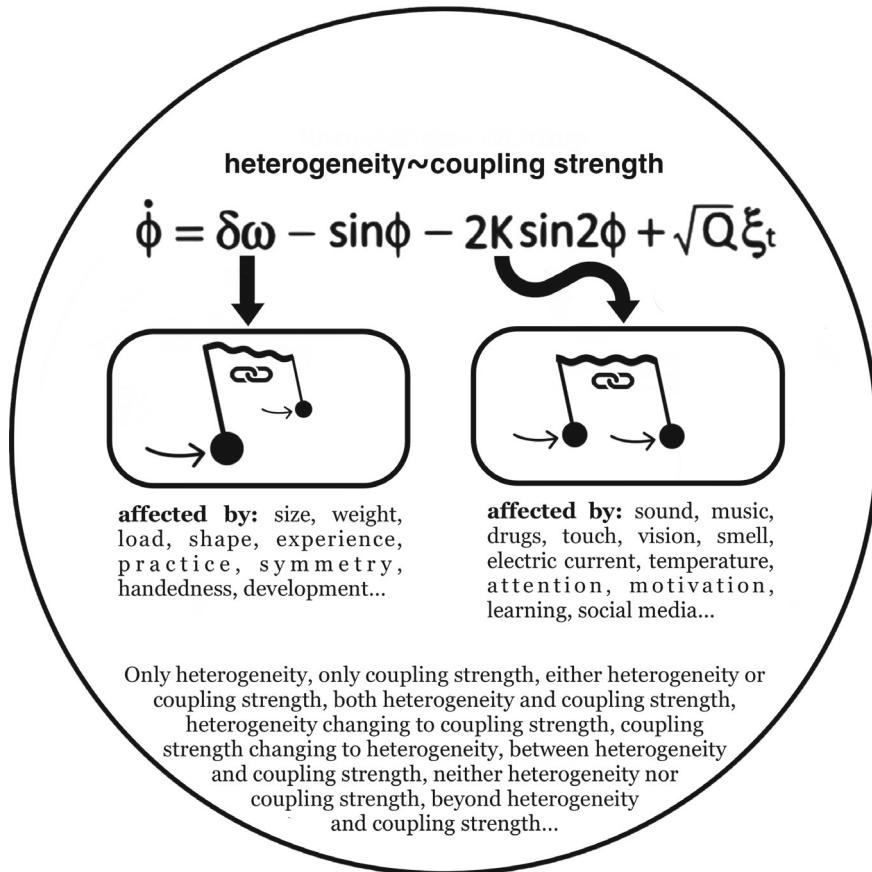


In Tar Baby, the classic concept of the individual with a solid, coherent identity is eschewed for a model of identity which sees the individual as a kaleidoscope of heterogeneous impulses and desires, constructed from multiple forms of interaction with the world as a play of difference that cannot be completely comprehended—Toni Morrison

Heterogeneity and coupling strength are complementary aspects at the very core of Coordination Dynamics (CD). The complementary nature of heterogeneity~coupling strength directly affects and shapes the universal self-organizing behavior of dynamic patterns. This squiggle is so fundamental to the CD paradigm that each aspect is included as a term in the Coordination Law equation. How fundamental? Well, without some heterogeneity or differences between individual coordinating elements (components, parts, processes, impulses, desires, etc.) there can be no metastability, no metastable mode—no *squiggle sense*. And without any coupling between individual coordinating elements, there can be no coordination at all!

Indeed, coordinated patterns arise in a self-organized fashion as a result of nonlinear coupling between individual coordinating elements. This is true at all levels, whether it be chemical bonds at the molecular level, receptor binding at the synaptic level, network connectivity at the neural level, all the way to the interactions between a teacher and student at the social level, and so on. The term ‘K’ in the model equation stands for the coupling strength between individual coordinating elements. Coupling strength in the model is intimately tied to experimental control parameters that exert both quantitative and qualitative, specific and non-specific changes on the coordination variable, ϕ . So, one of the key determiners of how the coordination variable changes in time, $\dot{\phi}$, is by changes in coupling strength.

Another important term in the Coordination Law is delta omega ($\delta\omega$) which expresses the heterogeneity or difference between individual coordinating elements (cells, neurons, muscles, body parts, brain areas, people, virtual partners, visual, auditory, tactile stimuli, combinations of all of them). For example, to play a drum set successfully, you must coordinate the motion of your hands, arms and legs. These movements, their accompanying kinesthetic sensations and the sounds they produce are all nonlinearly coupled via your nervous system. But the shapes, sizes, weight and muscular composition of your hands, arms and legs are all different, never mind the neural circuitry! This heterogeneity affects your overall ability to keep the beat. Heterogeneity~coupling strength is a *squiggle* of the complementary code of CD with the amazing property that it is applicable to many situations. At the same time it is contextually sensitive to all system levels of the complementary nature.



The Metastabilian says: So coherent states, state transitions and tendencies of my brain, behavior and countless other system-levels are captured by the same coordination law, which characterizes spatial-temporal phase relations of obviously very different structure-functions. Similarly, links between materially different structure-functions of myself and all other coordinations of the complementary nature appear to be governed by fundamental nonlinear coupling. It's insightful to realize that the complementary nature not only benefits from but requires heterogeneity.

Related squiggles: diversity~unity, individual differences~group, separate~together...

33 Of Deterministic and Stochastic

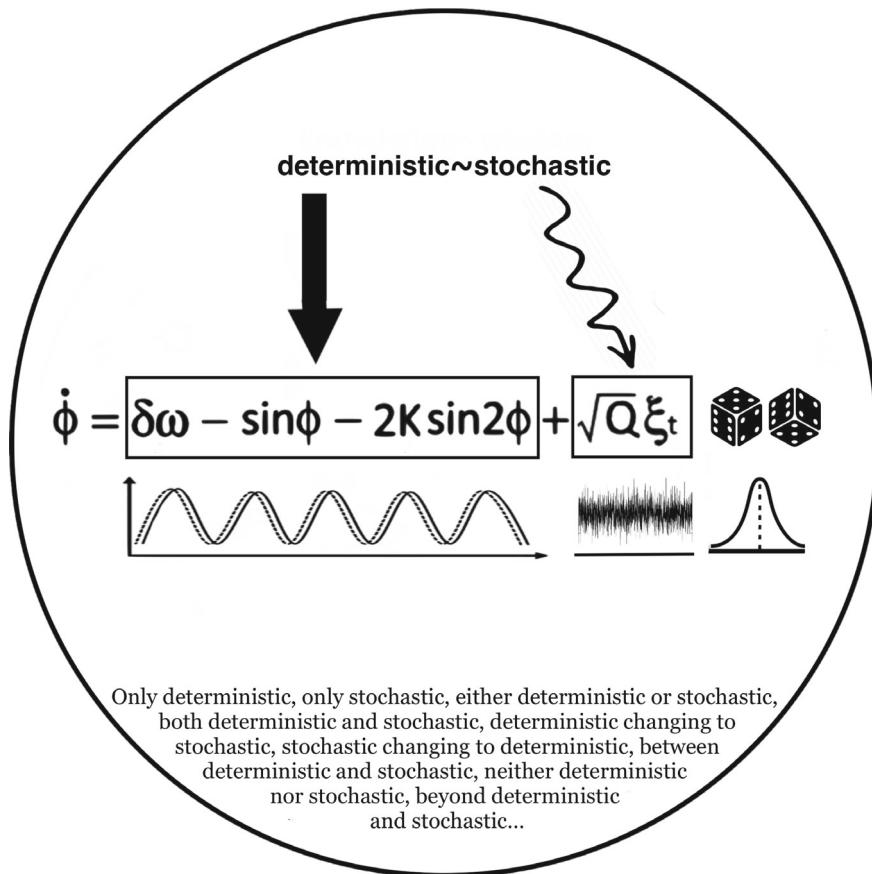


Chance and necessity. Reality needs both—Hermann Haken

You are a sentient being, self-aware and perceptive, full of feelings, thoughts, memories, emotions, beliefs and opinions. Usually, these tend to be more or less stable entities, formed and developed over time. But life is also full of chance and imperfections—uncertainty, inconsistency, even error. How do you believe chance affects your daily life? Do you think that life is fundamentally deterministic, causally determined by preceding events and natural law, or is it essentially stochastic, statistical in nature, random, predominantly run by chance and probability? Do you think your preference affects your life and how you live it? Debates on such questions over the ages are legion. And yet, eons worth of thought and argument have generated more heat than light, and scant resolution.

Perhaps instead of resolutions, reconciliation is needed, a fresh perspective for progress to be made. Perhaps life is somehow essentially both. In this context, consider engaging your *squiggle sense* to explore the idea that life may well be essentially both deterministic and stochastic, that they are in fact inextricably related, complementary aspects, basically a *squiggle*. In that case, you already know one useful thing, that their complementary nature is grounded in Coordination Dynamics (CD). You can immediately wonder, for example, if choice and chance are somehow captured by the Coordination Law equation. Indeed they are. Together, the first three terms of the right hand side of the model equation are deterministic. Theoretically speaking, they serve to predict a system's dynamic patterns, that is, how a system will behave.

But as you know life always includes uncertainty. Chance is always lurking. Dynamic imperfections, random fluctuations, often called ‘noise’ or ‘statistical effects’, also exist. The last term on the right side of the equation is called a ‘noise term.’ It models the fact that all real systems are subject to fluctuations, the source of which lies both within the system itself and its environment. In CD, how a system behaves is always based upon both deterministic and stochastic processes. Deterministic~stochastic is a crucial *squiggle* of the Complementary Code of CD. All real systems, like you, have elements of both in all synergies and at all levels. Plan and accident, signal and noise, choice and chance, stability and variability *squiggle* right along with your thoughts and actions, desires and deeds. Decisions you make depend on both. Without them, life as you know it would neither be recognizable nor sustainable. ‘Noise’ provides an essential source of variability, without which selection cannot work, never mind skill.



The Metastabilian says: I am a human being, I am sentient, aware, full of agency and intention. I live my life, make plans, follow my inspirations. My awakened *squiggle sense* helps me to appreciate that I'm a creature of the complementary nature, neither purely deterministic and predictable nor purely stochastic and probabilistic. I'm a mysterious creature, both determined and uncertain. Stochastic chance processes can lead to impediments and negative, unexpected outcomes, yet are also essential to the very vitality and humanity that defines and shapes my being~becoming, my self-awareness, my behavior, my humanity.

Related squiggles: of states~fluctuations, pattern~randomness, destiny~chance...

34 Of States and Transitions

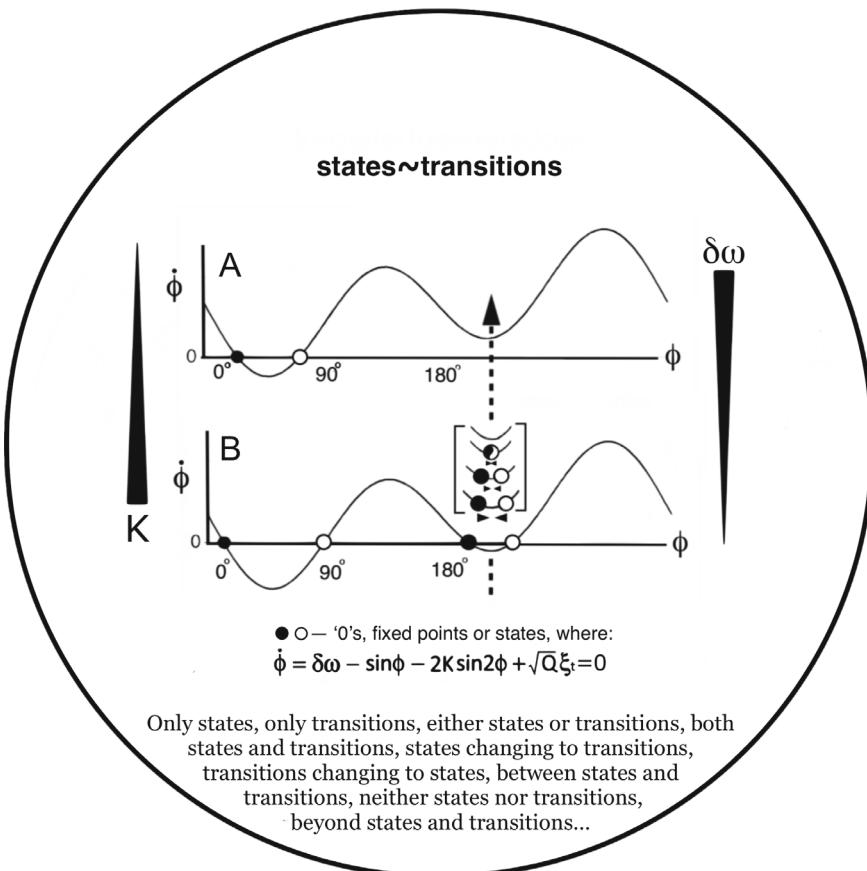


Power ceases in the instant of repose; it resides in the moment of transition from a past to a new state, in the shooting of the gulf, in the darting to an aim—Ralph Waldo Emerson

Knowing that the Coordination Law equation exists and what all its terms mean is a crucial first step on your *squiggle* quest. But what comes next? How do you use it to help you better understand and appreciate the *squiggle sense* of yourself and world? A useful next step is to become acquainted with the graphs of the model, to learn what they reveal about the *squiggles* of the Complementary Code. The way scientists do this is ‘feed’ the model equation data and plot the outcomes as graphical visualizations. One such primary plot is of *phi-dot* versus *phi* (ϕ), which means: how *phi* is changing at the moment *versus* the current value of *phi*. Ironically, a common way to begin analyzing this kind of graph is to note where the relative phase, *phi* isn’t changing. This happens wherever the solution of the equation for *phi-dot* equals zero. Those relative phases will persist until something in the equation is changed.

These zero points are called ‘fixed points’ of the equation. In physics, they correspond to states. Of course, state is a familiar word, as in physical states of matter, states of mind, energy states, even nation states. Which states persist (i.e. long enough to be observed) depends on their stability. Some states like the black dots in the picture are stable and attracting. Others, like the white dots are unstable and repelling. And of course the states themselves also change. Think of ice, water and steam, the different physical states or phases of matter. The ‘persistence of states’ *squiggles* with ‘qualitative changes of state’ in the coordinated *squiggle* dance of being~becoming. That the *phi-dot* versus *phi* plot provides a visualization of lawful persistence of coordinated states and transitions between them makes it an incredibly valuable tool. That it reveals more *squiggles* of the Complementary Code makes it even more so.

In both physics and Coordination Dynamics (CD), the moment of qualitative transition from one state to another state is called a phase transition, like the transitions at the freezing and boiling points of water. In CD though, stability thresholds are tipping points between qualitatively distinct patterns of coordination. While the idea that states have identifiable, predictable forms seems evident, the fact that transitions between states also do may seem less obvious or familiar. Actually, a system’s behavior near transition points between two states is accompanied by certain predictable, universal effects that provide a window into underlying mechanisms of change. In fact, a number of signature phenomena surrounding phase transitions were discovered that led to the further development of CD. And guess what? They’re all *squiggles*!



The Metastabilian says: Here now, a way to visualize intuitions of my *squiggle sense*! In ‘B’ above, I notice that more than one dynamic *state* can exist at once. I can see that the zero points (*fixed points, states*) come in pairs, and wonder what that means? I can see in ‘A’ that some change in the equation has led to the *squiggly* graph being shifted, ‘raised up’ so that two of the four zero points, (*fixed points, states*) disappear—a phase transition or bifurcation has occurred! I know that such transitions of coordination patterns are happening all the time in the physical world, in my body, even in my thoughts and interactions with others. Can the Coordination Law equation allow me to visualize even more about my *squiggle sense* and the complementary nature? And what about the rest of the graph besides the ‘zero points’? What other mysteries can be revealed and explained with such graphical visualization?

Related squiggles: persistence~change, structure~function, smooth~abrupt...

35 Of Attraction and Repulsion

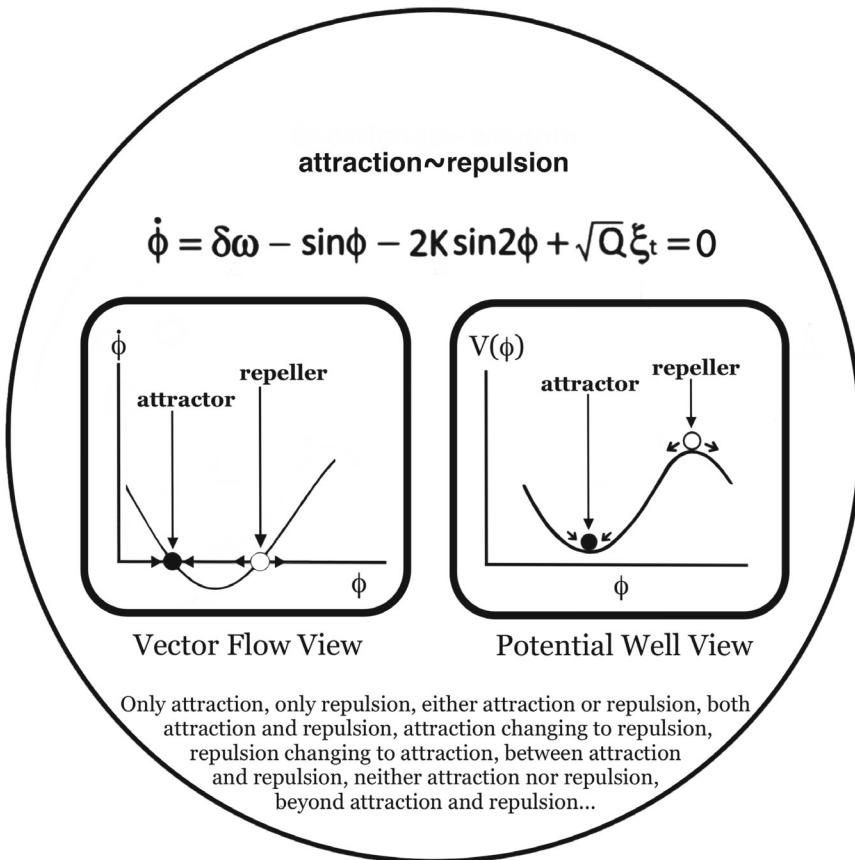


Without contraries, no progression. Attraction and repulsion, reason and energy, love and hate, are necessary to human existence—William Blake

Of all the *squiggles* necessary to your human existence without which there could be no progression, attraction~repulsion surely ranks supreme. Attraction and repulsion are iconic expressions of physical polarity, as in bar magnets, from which comes the common experience that opposites attract and like poles repel. But attraction~repulsion in the dissipative, complex, synergetic systems of life that involve neurons, brains, behavior, minds, beliefs and opinions isn't as fixed as polarized bar magnets. It's more dynamic, flexible and contextual. In human behavior, opposite, contrary, polarized opinions rarely attract one another and often lead to conflict. "Like likes like" often runs the show, like 'like' buttons on social websites. In CD, attraction and repulsion emerge and disappear together due to the nonlinear dynamics of the Coordination Law.

Details of the CD of attraction~repulsion are revealed in the model equation plots, where attracting and repelling zero or 'fixed point' states come in pairs, often symbolized by filled and open circles. The black filled circles on the x-axis of the plots are attracting fixed point states. In Vector Flow plots (ϕ -dot vs. ϕ), when the slope near a fixed point is negative, changes in ϕ -dot are decelerating. Trajectories from any nearby initial conditions converge toward such 'fixed point attractors', where ϕ -dot = 0. The open circles on the x-axis of the plots are repelling fixed point states. When the slope around them is positive, changes in ϕ -dot are accelerating. Trajectories from any nearby initial conditions diverge away from the fixed point where ϕ -dot = 0, and will not return to it spontaneously. Such fixed points are called repellers.

A different but entirely parallel visualization of this behavior is provided by the Potential Well view— $V(\phi)$ versus ϕ . Its minima and maxima correspond more intuitively to attraction and repulsion. Imagine the fixed point as a ball at rest at the bottom of a well where it remains at rest. Push it, and it wiggles down and stops again at the fixed point as if attracted to it. Oppositely, a ball at rest at the peak of a hill (repeller) remains at rest, until nudged, then takes off down the side of the well as if repelled. The *squiggle* dance of attraction~repulsion is essential to CD. It's used to predict a synergetic system's behavior. The layout and location of attractors and repellers dictate the ongoing flow of the dynamics. Attractors, where a system's behaviors converge indicate stable coordination states. Repellers, where a system's behavior diverges, indicate intrinsically unstable states. And beyond where attracting and repelling fixed points disappear, metastable, complementary tendencies reign!



The Metastabilian says: It's a mystery and miracle that I'm somehow able to be both attracted and repelled by features of my life, which persist and change depending on the intricacies of the CD at play. It's incredible that a graph of a mathematical equation can capture the essence, the inner workings, the complementary nature of attraction~repulsion. The graphs help me visualize and conceptualize *the squiggle sense* of attraction~repulsion, like how attraction and repulsion emerge and disappear together! With this novel insight, I can suddenly imagine how to better avoid the extremism, intransigence, intolerance and hubris of polarized thinking.

Related squiggles: convergence~divergence, affinity~aversion, constraints~freedom...

36 Of Stability and Instability

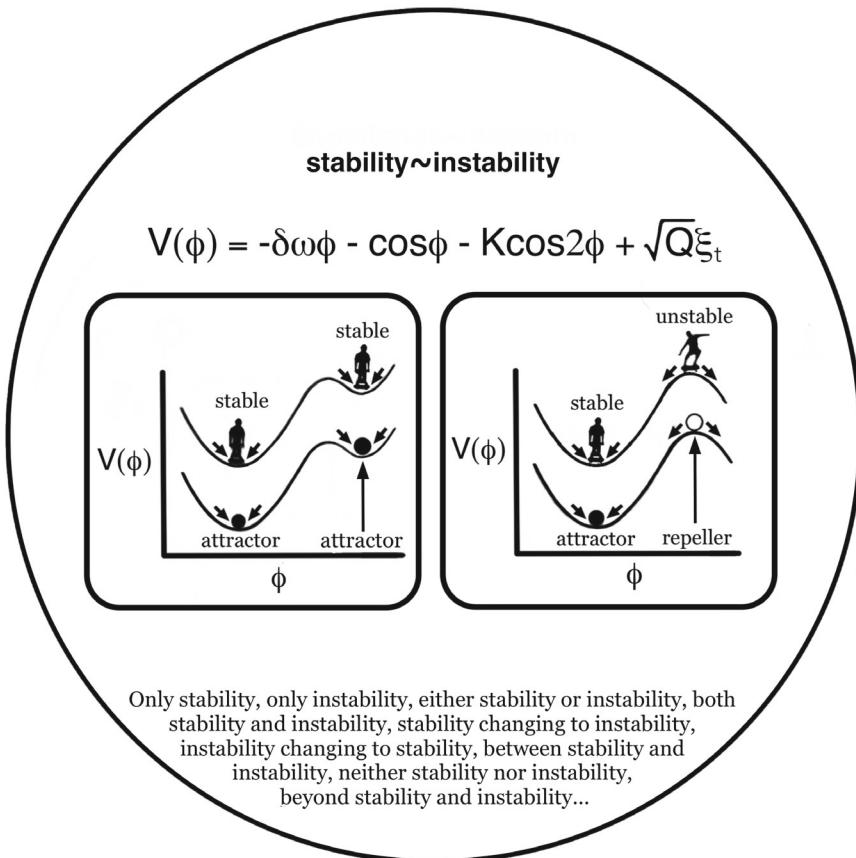


Reflect frequently upon the instability of things, and how very fast the scenes of nature are shifted... Change is always and everywhere at work; it strikes through causes and effects, and leaves nothing fixed and permanent—Marcus Aurelius

Understanding the complementary nature can never only be about change and the instability of things. After all, things are things precisely because they persist, even if not permanently so. Stability, the resistance to change, strength to stand or endure, is a *sine qua non* of existence. A *squiggle sense* update of Aurelius's wisdom would be to say that stability and instability are always and everywhere at work, striking through causes and effects, leaving nothing permanently fixed—even change itself. Indeed, both the phenomena of stability and change in nature and the conceptual complementary nature of stability~instability are grounded in Coordination Dynamics (CD) as revealed by visualizations of the elementary Coordination Law.

To name some key examples: (1) Fixed point states of relative phase *phi* (φ) come in two complementary contrary types, stable attractors and unstable repellers. Note that in both coordination states, *phi-dot* = 0. But behavior of phi near the contrary fixed point states is drastically different. In the Potential Well plot you can see intuitively how values of phi will settle back to the fixed point of a stable attractor state, and how it will depart from an unstable repeller fixed point with the slightest nudge never to return spontaneously. (2) Stable and unstable fixed point states can appear and disappear together, depending on the parameters of the model. (3) Due to changes in model parameters like heterogeneity, coupling strength and statistical fluctuations of individual coordinating elements, a synergetic system may reach a stability threshold where a current state loses stability and a more stable state emerges spontaneously—this process is called a bifurcation or phase transition.

Analysis and reflection upon the stability~instability of states~transitions in CD led to the realization that instability is a universal, generic, dynamical mechanism underlying flexible switching between dynamic patterns in different systems, levels and contexts. Dynamical signatures of instability enabled discovery and identification of the key coordination variables that characterize nature's dynamic patterns. Two of these, 'enhancement of fluctuations' and 'critical slowing down', played key roles in the development of CD. And guess what? They *squiggle*! Without the *squiggle* dance of stability and instability, neither states, transitions between them, nor many other key features of CD such as multistability and metastability would have been discovered. Life, sentience, intention, learning, coordination all require instability just as much as they do stability!



The Metastabilian says: I reflect frequently upon the stability~instability of things, how the scenes of my life shift depending on my frame of reference. Change~persistence is ever at work, striking through causes~effects, leaving nothing fixed and permanent for too long. My *squiggle sense* allows me to comprehend the *squiggle* dance of stability and instability of perception~action and my brain~mind.

Related squiggles: persistence~change, linear~nonlinear, smooth~abrupt...

37 Of E.O.F and C.S.D

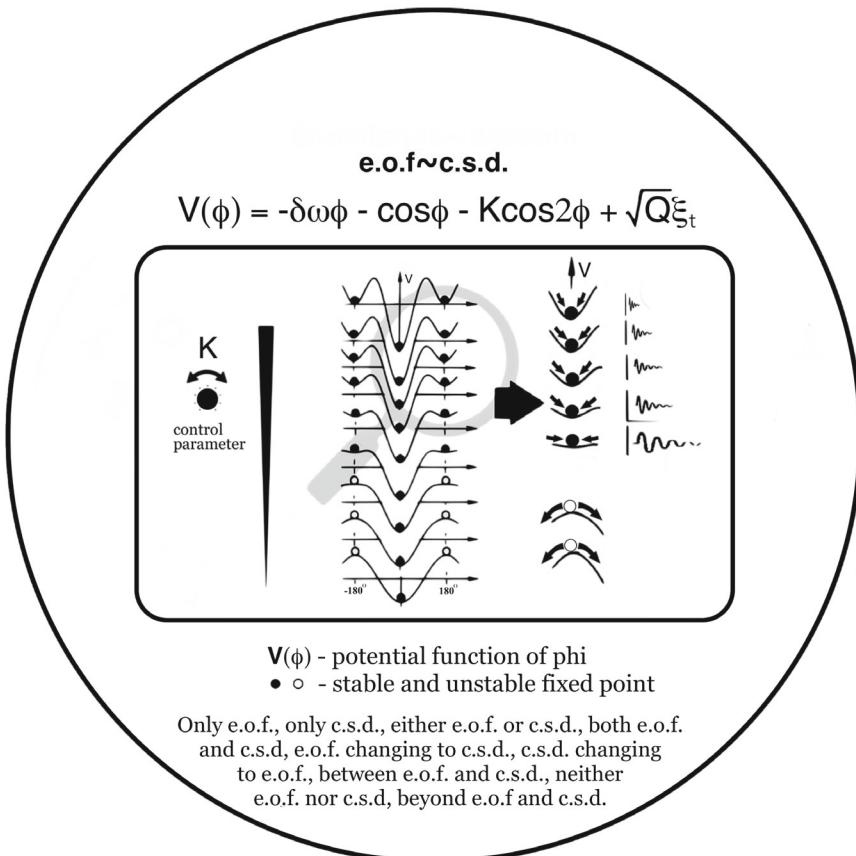


Each system is trying to anticipate change in the environment—Kevin Kelly

As the Coordination Law successfully predicts, in open, synergetic, nonlinear dynamical systems like you, enhancement of fluctuations (e.o.f.) and critical slowing down (c.s.d.) are universal signatures of dynamic instability and predictors of change. Experiments show that they often precede dramatic, qualitative change—a phase transition is imminent! Random fluctuations are always present in dissipative dynamical systems. Far from thresholds of instability, fluctuations exist but their effects may not be pronounced or consequential. As the system approaches a phase transition, however, the effects of fluctuations are ‘enhanced’, their influence grows. Variability of the current patterned state increases as it loses stability and a new pattern self-organizes and reveals itself. A deep insight revealed by analysis of fluctuations is that loss of stability is neither instantaneous nor totally random. In certain scenarios, e.o.f. means it’s possible to anticipate change!

Critical slowing down refers to a palpable increase in the time a dynamical system takes to recover from perturbations as it nears a phase transition. Like fluctuations, perturbations result in deviations from the system’s current state, and take some time to recover from. In CD, critical slowing down is studied by systematically perturbing a coordination pattern, and measuring the time it takes for the pattern to return to normal. Near a qualitative phase transition, the Coordination Law predicts this “relaxation time” will increase. That is, as a system becomes less stable it takes longer and longer to recover from tiny perturbations, an anticipatory sign of impending change. Something is going to happen!

E.o.f and c.s.d. are complementary aspects of dynamic stability-instability that transcend specific details. They can signal an upcoming earthquake, an epileptic seizure or a heart attack, and can be viewed as universal aspects of certain kinds of phase transitions. That these quantitative complementary signatures of instability presage qualitative change is quite remarkable. You can see how the shape of the Coordination Law’s Potential Well plot is systematically altered by the control parameter (K). E.o.f. and c.s.d. result from the ‘attractive well’ of the potential’s minima becoming shallower and the effects of fluctuations and perturbations becoming greater as the system nears a tipping point or phase transition. *The squiggle sense* is to realize that control parameters can alter the shape of life’s dynamical landscape and that small fluctuations and perturbations will always be around to test its stability~instability!



The Metastabilian says: When I'm far from threshold of some change that involves me, fluctuations and perturbations don't affect me much. But when they become critical, things become erratic, variable, hard to maintain. Suddenly I'm very sensitive to perturbations, a dog barking, an offhand remark, a bright light. I become distracted, find it hard to settle down, to relax, to focus. To know that these changes in my perception and action indicate a threshold is near is illuminating! I'm able to use these signs to anticipate impending change in myself and my environment. I can better appreciate that as frustrating, annoying, difficult as enhancement of fluctuations and critical slowing down can be, they're features of the same dynamics that allows me to change flexibly from one coordination pattern to another. My life and awareness depend on my sensitivity to them...

Related squiggles: anticipation~reaction, variability~stability, choice~instability...

38 Of Coordination Law and Dynamical Landscape

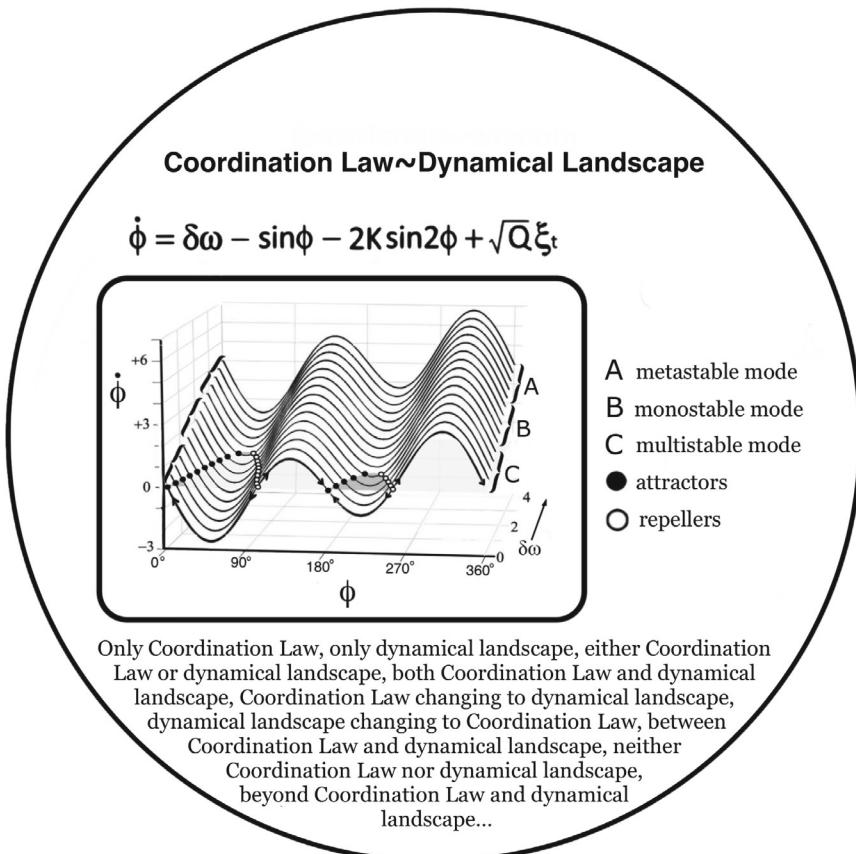


I had the landscape in my arms as I painted it. I had the landscape in my mind and shoulder and wrist—Helen Frankenthaler

The term dynamical landscape is a picturesque name for the ‘big picture’ view of Coordination Dynamics (CD). It’s intended to conjure up an image of how all the phenomena modeled by the Coordination Law form a flexible, evolving terrain—a dynamical landscape. In other words, the flow of coordination behavior captured by the Coordination Law has an underlying, cohesive, predictable shape. Such dynamical landscapes of self-organizing, flexible, adaptable synergetic systems are affected by factors such as the heterogeneity of the individual coordinating elements and the coupling between them. And such factors change in time. Yet remarkably, they change in a way that can be understood and predicted by the Coordination Law.

Practically speaking, all the different graphical visualizations of the Coordination Law are really different perspectives of the same dynamical landscape, each in its own way providing valuable information and insights. But for those unaccustomed to them, the graphs can be as intimidating as the equations. Interpreting and understanding specific details of the graphical visualizations and how they capture and express nuances of the paradigm and phenomena of CD is undeniably challenging. Enter the big picture view of the dynamical landscape, which provides you a powerful conceptual image of the Coordination Law governing synergetic, pattern forming systems.

Imagine yourself as an informationally-coupled self-organizing system, whose evolving dynamical landscape follows the Coordination Law as you live your daily life. There is the dynamical landscape of your body, specifying the coordination among its moving parts. There is also the dynamical landscape coordinating your body and the world, the organism~environment, as well as your relation to other people, animals, tools and machines. And there is the dynamical landscape of your brain~mind. When you read and think about a *squiggle*, the dynamical landscape of your brain~mind shifts and your *squiggle sense* becomes engaged. Now, you can use the graphs of the CD law to analyze your own coordination behavior scientifically—though you probably won’t. Still, being aware of the Coordination Law and how it shapes the dynamical landscape of synergetic systems is of great potential benefit and inspiration. The Coordination Law~dynamical landscape constitutes a paradigm shifting advance in knowledge and understanding of life’s patterns available to everyone. It allows you to know yourself.



The Metastabilian says: Life is fleeting, each passing moment filled with patterns upon patterns of coordination, within me, between myself, others and the world. It's a marvelous cacophony, so complex and chaotic in so many ways, coherent and simple in others. I think of all the transitions, shifts, changes of my mind, mood and movement that happen in a day, each task requiring a different feel, mode and dance to successfully accomplish it. Is there really any hope of understanding how it all works, how it all comes to be? Yes! By comparison, the equations of the CD Law and plots of its dynamical landscape aren't really so inaccessible to comprehend. That they can capture all these different coordinations of my life, and scientifically ground my *squiggle sense* which I use to comprehend the complementary nature, is mysterious, profound and inspiring.

Related squiggles: theory~practice, equation~simulation, map~territory...

39 Of Dynamical Landscape and Coordination Modes

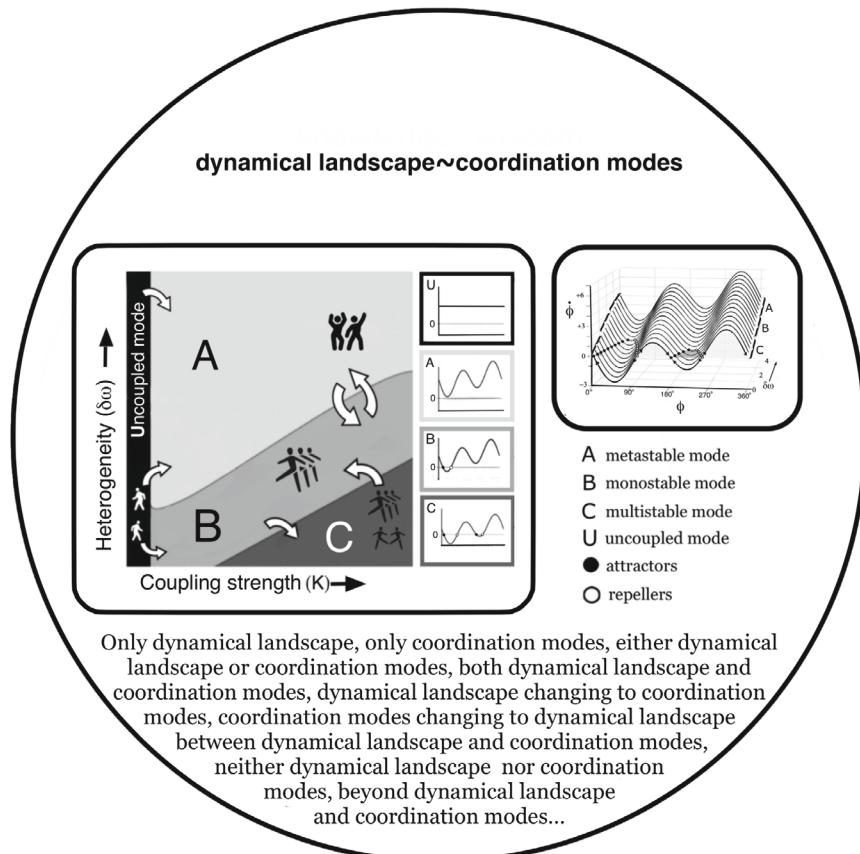


Most of an organism, most of the time is developing from one pattern to another, and not from homogeneity into a pattern—Alan Turing

The behavior of a living, synergetic system like you consists of a set of trajectories on a manifold that's diverse, contextual, and idiosyncratic—an evolving flow of different possible coordination patterns, all of which follow the Coordination Law. Behavior is nonlinear and changes from one pattern to another. It can go backwards, forwards and sideways, round and round, up and down... It's not just coordination patterns that emerge, persist and change in real time, but also the possible transitions between them. In Coordination Dynamics (CD), all possible coordination patterns that you can express, quantitative changes within them and qualitative transitions between them, can be imagined and visualized as a dynamical landscape whose shape depends on a variety of different factors or (in scientific lingo) control parameters. The *squiggle sense* of your dynamical landscape is revealed via visualizations and computer simulations of the Coordination Law.

A good way to see what's going on is by means of the “Parameter Space” view, which shows how different coordination modes persist and change as a function of the model's two control parameters, heterogeneity ($\delta\omega$) and coupling strength (K). All possible coordination patterns of the dynamical landscape fall into four different regions or archetypal coordination modes: (1) the uncoupled mode—coordinating elements move freely, independent and uncorrelated. No collective coordination states exist between them. (2) the metastable mode—coordinating elements are weakly coupled and differ in their intrinsic properties. Although no stable states exist, remnants or tendencies of stable states guide flexible coordination. (3) the monostable mode—coordinating elements are strongly coupled into a single stable coordination state. (4) the bistable or multistable mode—where two or more stable coordination states coexist.

In the Parameter Space view, arrows highlight different routes of change or travel between the four coordination modes of the dynamical landscape. Different combinations of parameter values can yield the same coordination modes. In some regions of parameter space, small changes in parameter values can lead to abrupt changes in modes. In others, large changes in parameter values produce no change at all. Life is nonlinear! Where you live in parameter space determines your behavior. Dynamical landscape~coordination modes is yet another foundational *squiggle* of the Complementary Code of CD. Its *squiggle* dance is the universal key to viable coordination, the full expression of the complementary nature.



The Metastabilian says: I imagine my life's journey in terms of the dynamical progression around my own flexible, evolving roller coaster dynamical landscape and its four different archetypal coordination modes—all of them realizable changes of the coupling strength and heterogeneity of individual coordinating elements of different systems of my body, brain, mind and behavior. And therein lies my metastable mode that entails and is entailed by the complementary code, that special combination of coupling strength~heterogeneity that allows me to engage my *squiggle sense* of the complementary nature. And just as compelling are the other modes that aren't metastable. It's amazing to realize that my *squiggle sense* emerges~vanishes along with my metastable mode. I can see now how it can become hidden when I fixate on thoughts and deeds!

Related squiggles: cause~effect, potential~flow, smooth~abrupt...

40 Of Uncoupled and Coupled Modes

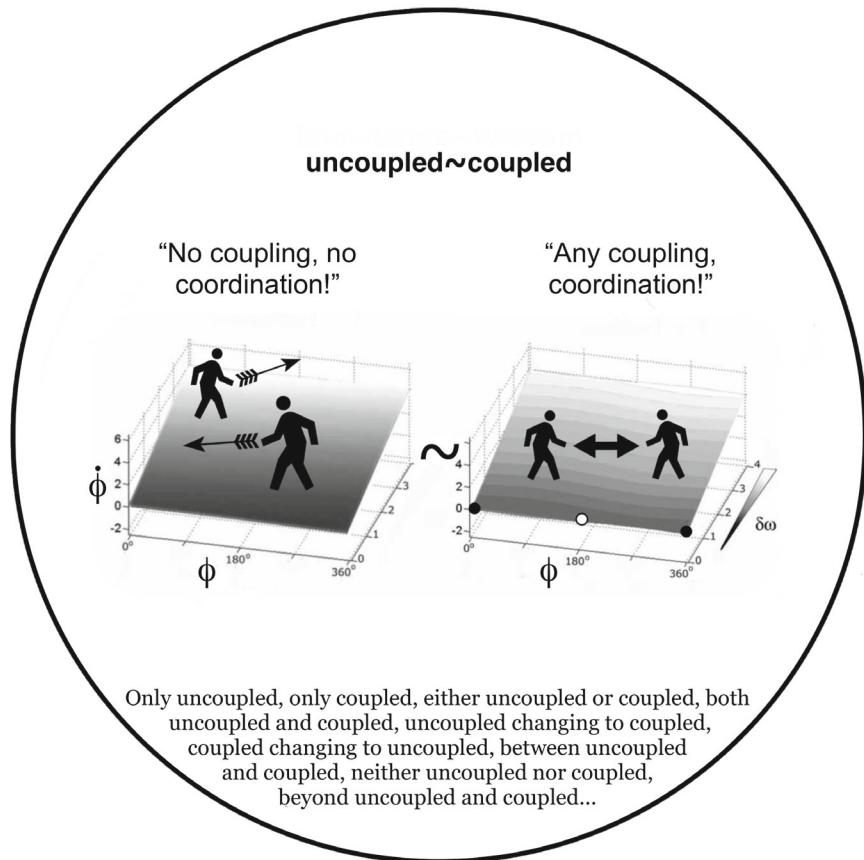


Freedom and constraint are two aspects of the same necessity, which is to be what one is and no other—Antoine de Saint Exupéry

The first of the four coordination modes in the dynamical landscape might seem a bit contradictory, though it's a mode all the same. When the coupling strength in the Coordination Law equation is zero, although individual coordinating elements may have the potential for collective coordination, they are at that moment uncoupled. They are free from one another, unbound and uncorrelated. Without coupling, they're free to do their own thing, to move and act independently. No self-organizing coordination between them and other elements can happen, no matter how similar or different their intrinsic properties might be. The mantra is, “no coupling, no coordination”. The uncoupled mode allows for the free movement expression of individual elements, their autonomy.

If walking down the street someone bumps into you and you both keep walking—no coupling, no coordination. But if the person asks if you are okay and you make eye contact (coupling), a dialogue ensues (coupling) and coordination begins. You say your goodbyes, go your separate ways. Coordination between you and the person ceases—no coupling, no coordination. So the coupling vanishes again, though a memory of your interaction might not. Experiments in social CD show that remnants or memory of social interactions can linger in individuals even after they separate and are uncoupled. Without the uncoupled mode, truly independent movement isn't possible, nor would the onset and cessation of new coordination patterns be possible. On the other hand, viability requires coordination, which requires coupling. An uncoupled element, as free as it may be, won't last long without coupling of some kind to its “environment”, whether natural or social. When that eventually happens, coordination begins anew.

The uncoupled and coupled modes of the dynamical landscape are complementary aspects. Wherever and whenever coupling and coordination is possible, uncoupling is also possible. This *squiggle* is as ubiquitous as coordination itself, and has many names. In neurosynaptic function, neurotransmitters bind with protein receptors (couple) at different affinities (coupling strengths), generate responses (coordinated actions), then release (uncouple, coupling strength diminishes to zero) and responses cease. The inextricable, complementary uncoupled~coupled modes of the universal dynamical landscape are fundamental, literally the beginning~ending of all coordinated dances. Together they're a *squiggle* essential to the complementary nature at all levels, from the molecular to the social.



The Metastabilian says: Without coupling, the phase flow of the dynamical landscape is flat. No phasic relationships, no coordination patterns. But when just the tiniest bit of coupling is introduced, I notice the delicate wrinkle in the phase-plane surface. Along with it emerge fixed points of the Coordination Law at '0' and '180' degrees, in-phase and anti-phase. Birth of coordination involves creation of both a stable and an unstable fixed point, a stable attractor and an unstable repeller. One doesn't exist without the other. I notice that in this case of minimal coupling strength, if there is any difference between the coordinating elements ($\delta\omega$), both fixed points vanish, even though the wrinkle remains. (I wonder what that means?).

Related squiggles: unbound~bound, unlinked~linked, freedom~constraint...

41 Of Monostable and Bistable Modes

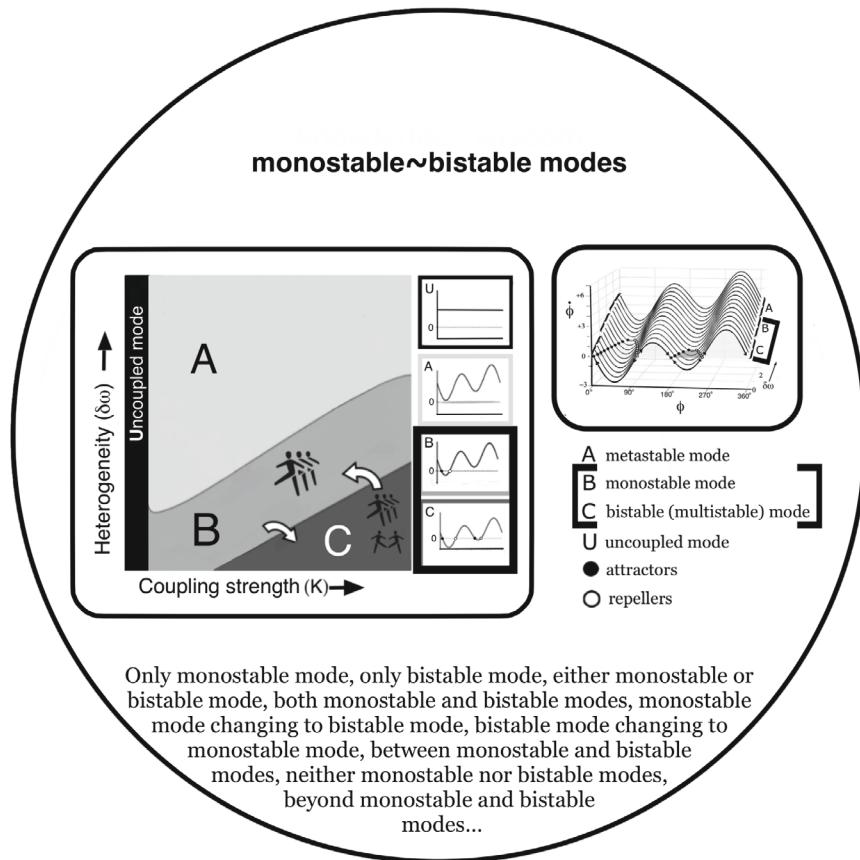


Multistability, the coexistence of several collective states for the same value of control parameters, is an essential property of biological coordination dynamics—J. A. Scott Kelso

Once there is any coupling between any individual coordinating elements, all the basic coupled coordination modes can emerge. The monostable and bistable modes have to do with stable states, represented graphically by the zero or fixed points of the Coordination Law equation. In the monostable mode, under current values of control parameters, only *one* stable coordination state or fixed point of the Coordination Law equation is present. It's associated with a close to zero phase relation called inphase or synchronized coordination. In the bistable mode, under current values of control parameters, two stable states or fixed points of the Coordination Law equation coexist. The first one is near zero relative phase corresponding to inphase or synchronization, and a second one near 180 degrees, corresponding to anti-phase or syncopation. Bistability is the simplest example of multistability—the existence of two or more states in a dynamical system for the same values of control parameters.

Notice that in-phase and anti-phase, synchronized and syncopated rhythms are polar contraries. In the bistable mode, equally valid polar alternatives coexist within the parameter space of the dynamical landscape. When control parameters like coupling strength are changed continuously by a scientist doing a laboratory experiment or, in the real world, by natural circumstances, the bistable mode can switch to the monostable mode, and vice versa. Such changes are indicated in the parameter space diagram as arrows crossing the boundaries of the bistable and monostable regions. In physics, qualitative switching from one mode to another is often called a phase transition. In mathematics, it's called a bifurcation.

The significance of the monostable mode and its main expression of synchrony is well established in nature. The bistable mode is a prerequisite for all duals and dualisms, polarization, dichotomy, binary explanations, dialectic, yin and yang—the switches and switching of brain and mental function. The complementary nature entails bistability by definition. In the context of monostability and bistability, the grounding of the complementary nature in Coordination Dynamics (CD) is clear. It explains how a single state can self-organize in the first place, how two stable states can coexist, and how transitions between them occur. The monostable and bistable modes of CD are a key *squiggle* of the Complementary Code, essential for coordination, life and awareness.



The Metastabilian says: It's insightful to realize that all polarities, all complementary aspects, all squiggles entail bistability, even when the complementary aspects are the monostable and bistable modes themselves! Just considering these two coupled modes and the uncoupled mode of the dynamical landscape, it's already clear how monistic and dualistic policies, while certainly present and valid in their respective parameter regions...are limited and limiting when treated as mutually exclusive. The multistability of the complementary nature offers an elegant flexible compromise in the accommodation and assimilation of qualitatively different alternatives within the vast spectrum of possible coordination dances—even including free movement of uncoupled elements. And CD shows me how it works.

Related squiggles: one~two, unity~plurality, threshold~bifurcation...

42 Of Multistable and Metastable Modes

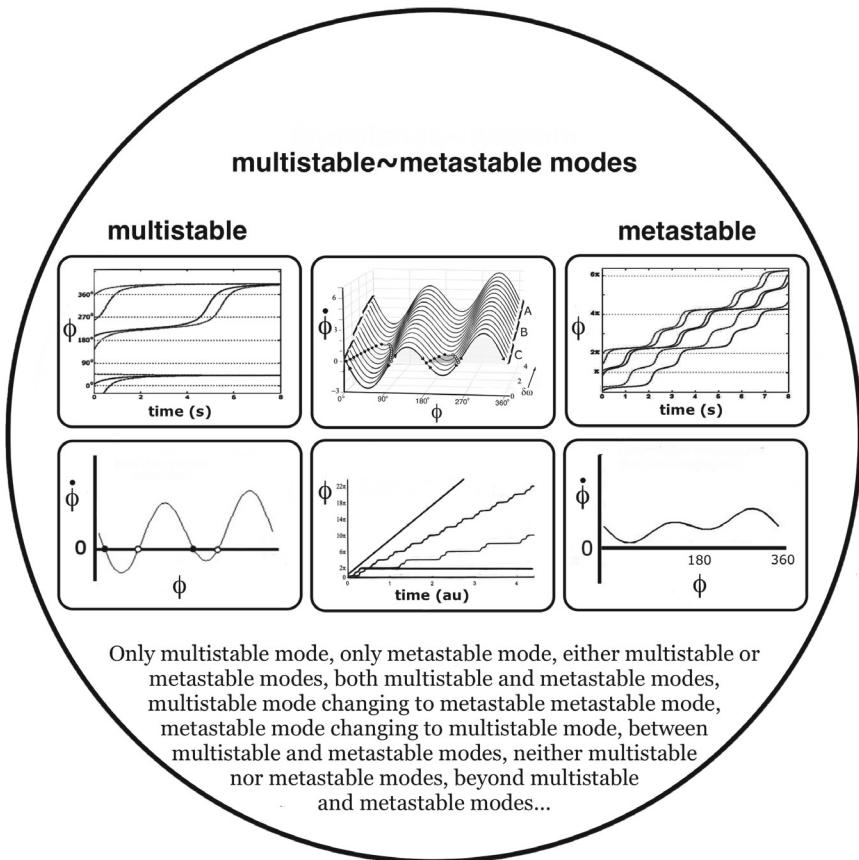


(1) There cannot be an intermediate between two contradictions, but of one subject we must either affirm or deny any one predicate. (2) Now it is a mean between two vices, that which depends on excess and that which depends on defect...the vices respectively fall short of or exceed what is right in both passions and actions, while virtue both finds and chooses that which is intermediate—Aristotle

In the multistable mode of Coordination Dynamics (CD) two or more stable attractor states can be expressed for both the same and different values of control parameters. Which one is expressed depends on initial conditions. The multistable mode is characterized by relatively higher coupling strength and lower heterogeneity between coordinating elements than the monostable region. Multiple stable states are separated by unstable repellers, and threshold surpassing instabilities (bifurcations or phase transitions) are required to switch back and forth between them. Notice how taken together, all possible multistable and monostable modes only comprise about half of the dynamical landscape. The other half is occupied by the metastable mode, where heterogeneity between coordinating elements is relatively higher than in the other regimes and plays a crucial role.

In the phase space pictures of the metastable mode, the entire Coordination Law function lies above the x-axis, beyond the zero line. Amazingly, there are no fixed points or stable states at all for half the dynamical landscape! So *phi-dot*, the change of relative phase over time, never settles, yet the squiggly shape of the mathematical model remains. Even though multistability has vanished, remnants of previously multistable states remain. In CD, these dynamical remnants are called metastable tendencies. A main discovery of CD is that similar to the multistable mode, two or more complementary tendencies coexist and shape the ongoing coordination. The metastable mode displays attraction and repulsion without attractors or repellers. It's a both-and kind of complementarity. Both relative phase tendencies are simultaneously present, and you can move flexibly from one to another without the necessity of crossing energy thresholds required for nonlinear phase transitions.

The coexistence of multiple dynamic steady states and metastable mode tendencies in CD is stunning and unexpected. Even complementarity itself is complementary: two contrary means of achieving qualitatively coexistent coordination patterns are reconciled in the same mathematical model! Fixed contrary polar extrema represent bistable states, while the intermediate world between those poles, is metastable. Your *squiggle sense* is a product and expression of your metastable mode, the included middle, a wellspring of virtue and wisdom. Multistability~metastability is a remarkable *squiggle* of the Complementary Code of CD, essential to your brain~mind function, your very awareness and all your sentient potential.



The Metastabilian says: My brain~mind embraces and entails both either/or complementarity of multistable states and both-and complementarity of metastable tendencies. It is my complementary nature. My dynamical landscape is a reconciliation of reconciliations! And as I reflect upon it all, I have a flash of insight: the vast metastable mode composed of tendencies, preferences and dispositions, isn't actually between contrary coexistent states at all. It's beyond them! And then another: At this very moment of insight, my *squiggle sense* is engaged. In this very moment, I am a metastabilian using metastability to reflect upon that metastability!

Related squiggles: states~tendencies, fixed~flexible, stability~novelty...

43 Of Integration and Segregation

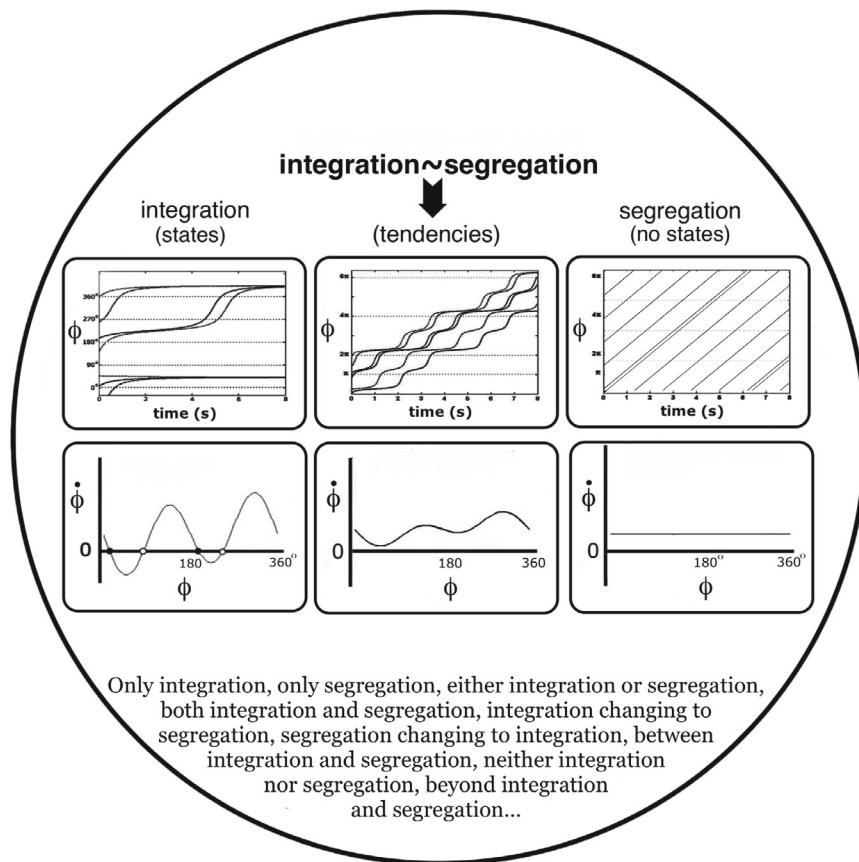


Synergy is cognate with metastable organization because, in the most general case, the synergic tendency of the involved degrees of freedom toward dependence (integration) is complemented by their anti-synergic tendency toward independence (segregation)—Michael T. Turvey

The complementary nature of integration and segregation plays an inherent, vital role in the synergic organization of living systems discovered, explored and modeled by Coordination Dynamics (CD). Synergies simultaneously reconcile their overall collective functions with the individual integrity of the coordinative elements (components, parts, members, processes, signals, thoughts...) that compose and form them. Dynamic, inextricable tendencies for individual coordinating elements to couple or bind together (integration), and for those same elements to retain and express their independence (segregation), coexist and function simultaneously. Such complementary integrative and segregative tendencies are exactly what is found in the metastable mode of CD. Like multistability and phase transitions, metastability is universal, relevant at all levels, including the very relevant level of your brain~mind.

Ample scientific evidence exists that metastability is essential for human brain~mind~body~world function. Metastability reconciles the two main current and contrary theories of brain function: One is called functional segregation: it treats the brain as segregated self-governing regions, each localizable and capable of performing unique functions, such as perception, memory and movement. This is partially true. The other is called functional integration: it treats the brain as an integrated organ where the parts function together as a unitary whole. This is also partially true. The metastable mode of CD reconciles independent, individualized tendencies of specialized brain regions and interdependent, collective tendencies of those same regions to work together as a functional synergy.

Now, by definition, your *squiggle sense* is activated and engaged in the metastable mode of your brain~mind's coordination dynamics, at the very level of your self-awareness. It depends on this extraordinary 'both-and' tendency complementarity entailed by metastability. Think of it. Your ability to perceive, ponder and reconcile complementary contrarieties, the *squiggles* of you and your world, requires you to engage your metastable mode. Metastability is characterized by simultaneous complementary tendencies for integration and segregation of the neurons and neural ensembles of your brain~mind as those perceptions, thoughts and reconciliations are happening—the flow of consciousness itself. The complementary nature, your *squiggle sense* of it and your brain~mind's awareness of it, are all based on metastable CD!



The Metastabilian says: Kahlil Gibran once wrote, “Let there be spaces in your togetherness and let the winds of the heavens dance between you. Love one another but make not a bond of love: let it rather be a moving sea between the shores of your souls”. The complementary tendencies for integration and segregation in the metastable mode of my brain-mind resonate perfectly with these profound, beautiful and wise words of the poet. From the view of CD, they are the poet in his metastable mode advising his readers to engage theirs. What an amazing thought: the complementary nature and metastability of love and wisdom!

Related squiggles: local-global, parts-whole, togetherness-apartness...

44 Of Dwelling and Escaping

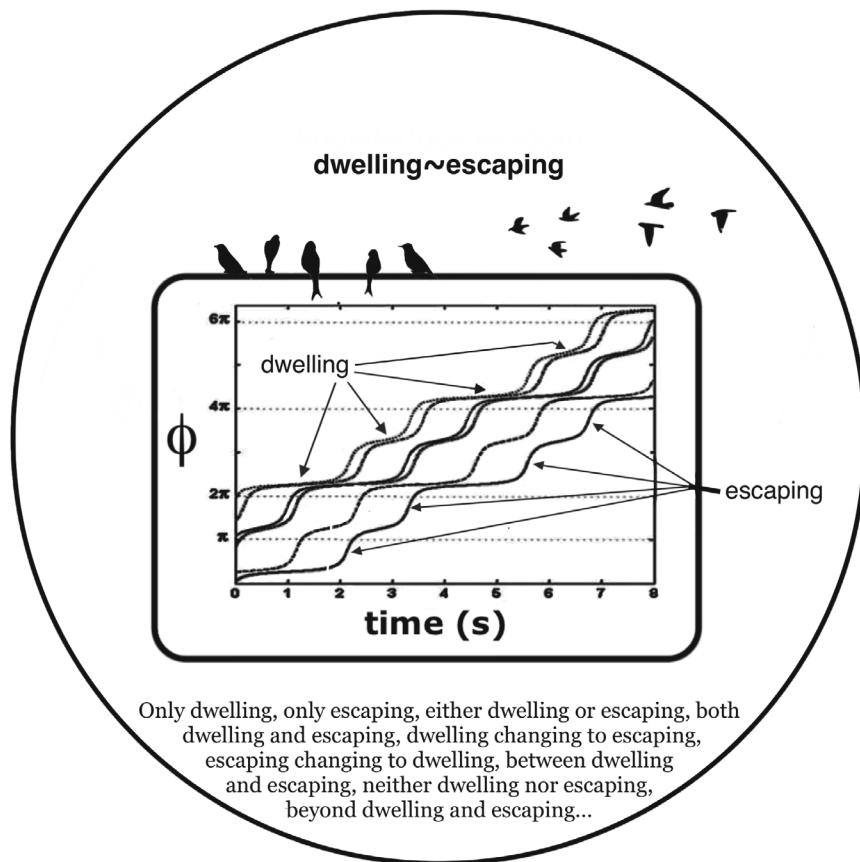


As we take, in fact, a general view of the wonderful stream of our consciousness, what strikes us first is this different pace of its parts. Like a bird's life, it seems to be made of an alternation of flights and perchings—William James

What does metastable integration-segregation look like in reality? Imagine that over some brief epoch in its ongoing metastable trajectory, the phase relation of a coordinating system continuously changes in time. In this epoch, even though the coupling strength between them is greater than zero, coordinating elements exhibit a tendency toward independent, segregated action, as if they were uncoupled, but not quite. As the escaping coordination variable ϕ approaches, say in-phase, it briefly dwells there, exhibiting a tendency for cooperative, integrated, coordination. Following this dwelling, the relative phase escapes again until it eventually converges toward and dwells near anti-phase, exhibiting a tendency again for integrated coordination. Its dwelling there soon ends and the phase relation escapes again, and so on. In the metastable mode, the system lives in a virtual sea of metastability. It never gets stuck.

This metastable dance of dwelling and escaping repeats as long as the system is in the metastable mode of its Coordination Dynamics (CD). In it, a segregative tendency to escape phase attraction coexists with an integrative tendency to dwell at preferred phase relations. The former provides the system with flexibility, the freedom to explore its full range of coordinative possibilities. The latter allows the system to maintain a certain degree of stability while doing so. So in the metastable mode, there's attraction~repulsion but no attractors or repellers. There are transient tendencies but no states. Metastability provides living systems the vital mix of flexibility and stability.

Escape velocities (how quickly a trajectory escapes dwelling), and dwell times (how long a system dwells near a preferred phase before escaping), are key measures of metastable coordination dynamics. They are a function of how strongly coordinating elements are coupled relative to how different they are from each other. The dwelling~escaping trajectories of the coordination variable ϕ over time reveal the actual evolution of coexisting integrative and segregative processes and tendencies. CD says that it is the metastable mode that underlies William James's powerful image of the stream of consciousness. Your brain-mind lives in a world of flights and perchings, of freedom and constraint, of escaping from and dwelling near bound states of coordination. In the context of Coordination Dynamics, metastability is the key to your life, awareness, the complementary nature and your *squiggle sense*!



The Metastabilian says: How easy it is for me to imagine the dwelling and escape of my awareness, perception~actions, thoughts...all of my coordinated behavior. All this simultaneous integrating and segregating at all the levels of my existence. It's all a grand and mysterious coordination. My stream of consciousness, that is, the complementary flights and perchings of my conscious~unconscious, weave all the *squiggles* of my life into the synergistic collective~individual reality I call my 'self'. It's amazing to imagine how the metastable process of my imagination imagines the way it works. This is the complementary nature!

Related squiggles: persisting~changing, constraint~freedom, pausing~moving...

45 Of Symmetry and Broken Symmetry

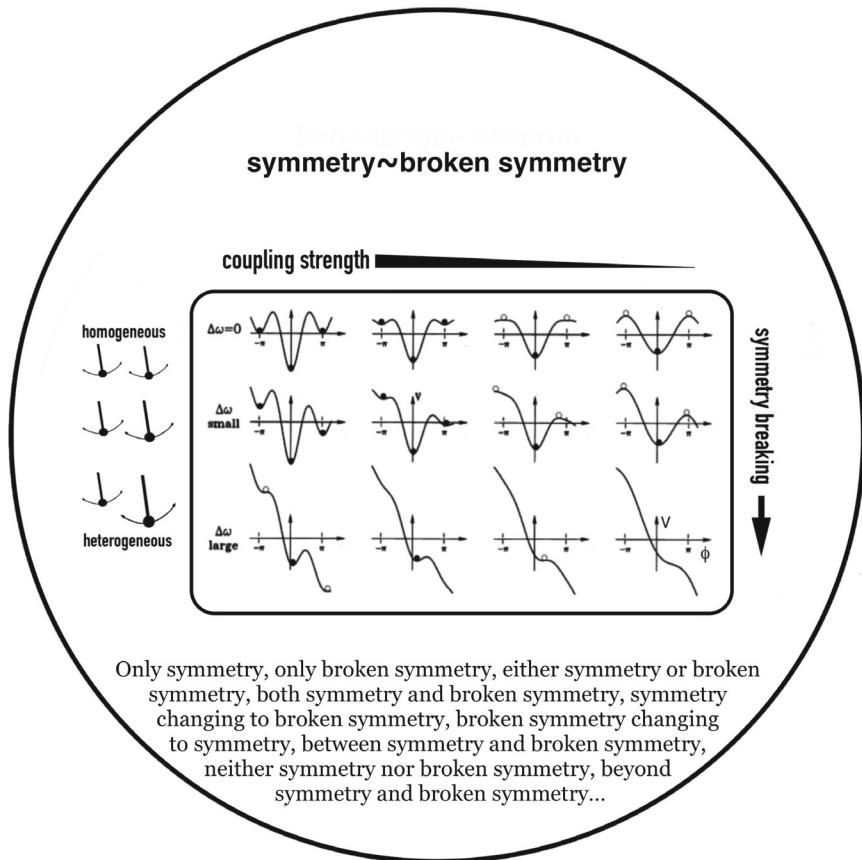


The symmetries that are really important in nature are not the symmetry of things, but the symmetries of laws—Stephen Weinberg

Symmetry comes from a very old Greek word. Its original, everyday meaning is “a harmonious agreement in dimensions; due proportion”. In the world of math and science, it has a more specific definition: “invariance of the form of an object or process under some transformation, like translation, reflection, rotation, scaling or time”. Symmetries are crucial in nature and our understanding of it, where they’re used to classify patterns. Indeed, the *squiggle sense* of symmetry~broken symmetry is the essence of metastability, of your metastable mode. To understand why, first realize that the full scientific name of the Coordination Law model is “the extended or broken symmetry form of the HKB model”, the original model of Coordination Dynamics (CD) named after its architects, Haken, Kelso and Bunz.

Now, an assumption of the HKB model’s original formulation is that individual coordinating elements are identical or nearly so. Their differences are considered negligible. In that case, the model is mathematically symmetric: It doesn’t matter whether time flows forward or backward (2π -periodic) and is identical under left-right reflection, where positive and negative relative phase *phi* (φ) behaviors are equivalent. This well known, thoroughly tested model captures the behavior and transitions between monostable, bistable and uncoupled dynamical coordination modes very well. But when coordinating elements, parts and processes are identical, even if coupled, metastability can’t happen. It’s only when they are heterogeneous that metastable tendencies emerge. To accommodate this fact, the HKB model equations had to be extended to include symmetry breaking. This ‘extended HKB model’ or Coordination Law beautifully captures the multistable~metastable *squiggle* dance of heterogeneity~coupling.

From broken symmetry and the weakest of coupling, metastability emerges. In the model, the $(\delta\omega)$ heterogeneity term bends and ‘tilts’ symmetrical potential attractor wells, which results in the ability of the system to both dwell in and escape basins of attraction. When heterogeneity vanishes ($\delta\omega = 0$), the equations return to the original, symmetrical HKB model: monostability, multistability, phase transitions and uncoupled modes, yes, but metastability, no. So what’s really important is the complementary nature of symmetry~broken symmetry of the Coordination Law. Your awareness, your metastable brain~mind, the complementary nature and your *squiggle sense* all require broken symmetry in the CD. That is their foundation.



Only symmetry, only broken symmetry, either symmetry or broken symmetry, both symmetry and broken symmetry, symmetry changing to broken symmetry, broken symmetry changing to symmetry, between symmetry and broken symmetry, neither symmetry nor broken symmetry, beyond symmetry and broken symmetry...

The Metastabilian says: Like nonlinearity, the critical importance of broken symmetries to life takes getting used to conceptually. But when I engage my *squiggle sense* to reflect upon the complementary nature of symmetry and broken symmetry, I realize I've known about it all along. For it's what I actually do and experience. The synergies, broken symmetries, metastabilities and *squiggles*, as strange and unfamiliar as their names might be, provide me the life and self awareness that I actually experience, and that allow me to contemplate them. And now it's possible for me to reconcile my life experience with the grounded science and all the phenomena expressed by the Coordination Law. It opens up a whole world of new possibilities...

Related squiggles: homogeneity~heterogeneity, similarity~difference, states~tendencies...

46 Of Competition and Cooperation

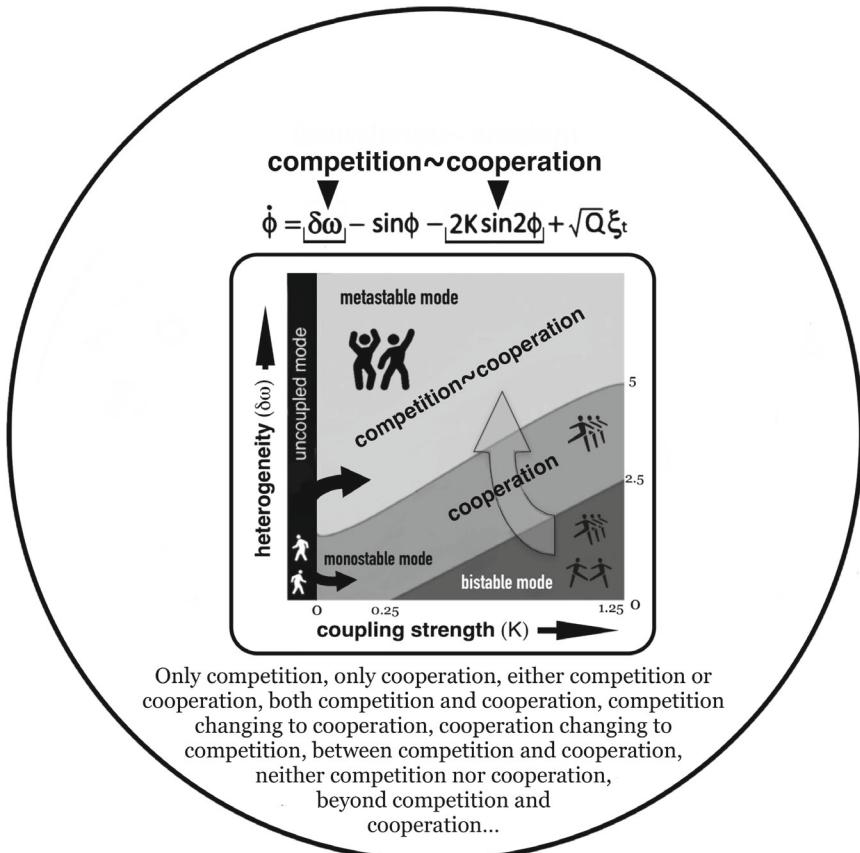


The delicate and intricate pattern of competition and cooperation in the economic behavior of the hundreds of thousands of citizens of Stockholm offers a challenge to the economist that is perhaps as complex as the challenges of the physicist and the chemist—George Stigler

Like all human beings, you are very familiar with competition and *cooperation*, with every move you make, hand you shake, deal you make... All you do in your life, how you make a living, survive, work, play, what's been and what's to be, are sculpted from them. They are classic, epic complementary aspects at the very core of coordination and your existence. Your behavior, thought, perception~action, learning~memory, brain~body function, emotions and the world you live in, all depend on delicate and intricate patterns of competition and cooperation of individual~collective synergies. No wonder the interplay of cooperation and competition lies at the heart of the Coordination Law. Life itself consists of the *squiggle* dances of their complementary nature, the universal, inextricable, Coordination Dynamics of these two key complementary aspects.

The term delta omega ($\delta\omega$) expresses how heterogeneity or differences between intrinsic properties of coordinating elements compete for dominance. Such competition alters the dynamical landscape, the collective, self-organizing coordination patterns of nonlinearly coupled elements. The term expressing cooperation in the Coordination Law is $2K\sin^2\phi$, where K stands for how strongly the elements are coupled. The *squiggle sense* of competition~cooperation indicates that mutually exclusive policies that favor one and dismiss the other will eventually fail. Without the natural competition inherent among heterogeneous coordinating elements, metastability cannot emerge. Without cooperation of individual coordinating elements, self-organized coordination and the emergence of self-awareness is not possible.

In adaptation and learning, many studies have shown that new information can cooperate and compete depending on its relation to a learner's current predispositions. Learning tends to be fast when new information cooperates with the learner's intrinsic dynamics, and slow and laborious when it competes. Transitions in adaptation and learning occur when competition between new and old information is reduced, giving rise to stabilization of learned patterns, a cooperative effect. Similar delicate, intricate complementary dances of competition and cooperation of coordinating elements and processes are manifested in countless other scenarios, in many different systems and on many different levels of organization. Such is the powerful and empowering *squiggle sense* of competition and cooperation, whose intimate connection with heterogeneity and coupling in the Coordination Law can hardly be overstated.



The Metastabilian says: With my *squiggle sense* engaged, I realize, accept and reconcile the inevitable, palpable, universal complementary nature of competition and cooperation in any and all system-levels. As amazing as that realization is, somehow it's not really that surprising. My body-mind has always known it. Yet in day-to-day life, often as not competition and cooperation are treated by so many as separate, mutually exclusive aspects, with one valued over the other as primary and fundamental. Then it hits me: without the natural *squiggle* dance of competition and cooperation in my brain-mind, body and behavior... the awareness necessary to choose competition over cooperation or vice-versa wouldn't even be possible!

Related squiggles: inter~intra, conflict~accord, sports~players...

47 Of Creation and Destruction of FI

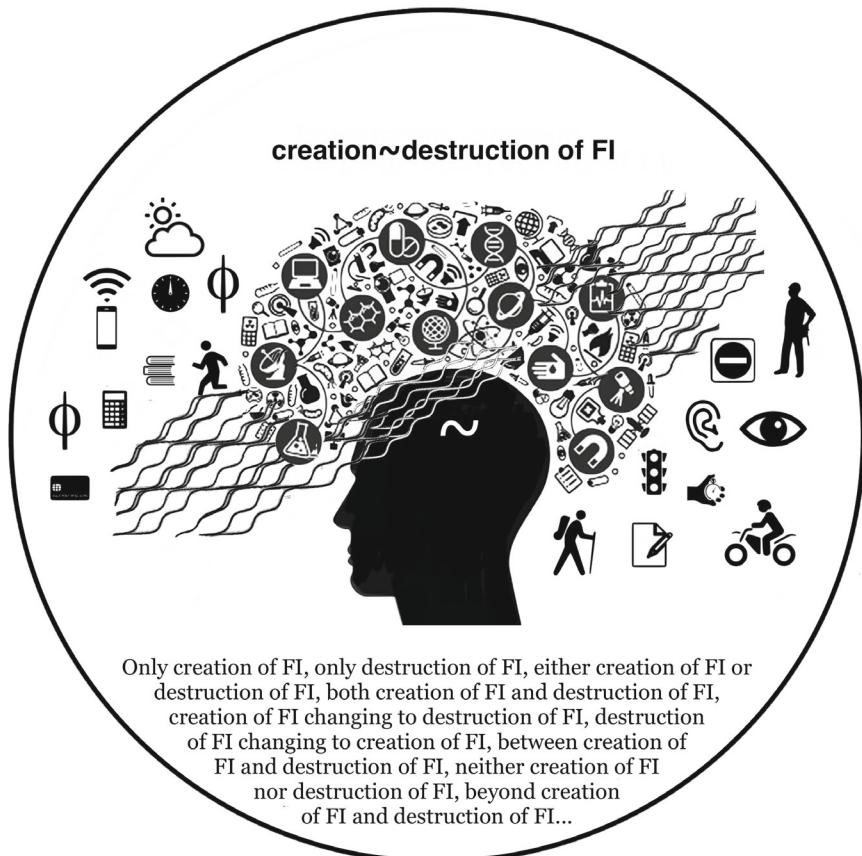


Creation and destruction are the two ends of the same moment. And everything between the creation and the next destruction is the journey of life—Amish Tripathi

As a sentient, self-organizing synergetic being, you survive and thrive amidst a dynamic flux of information. The *squiggle dance* of information is palpable. It's dynamical creation and destruction is an ongoing reconciliation of sensation and awareness that fills your life with diversity and nuance, inspiration and warning. But information can also be counterproductive, intimidating and misleading. There can be too much and too little, and both extremes can be detrimental. Now, considering the stupefying, omnipresent deluge of addictive, readily accessible online information available today, it's easy to forget that information has been crucial from the very beginning of sentient awareness, before the internet, computers, libraries, books, the printing press, predating civilization itself.

Indeed, information's original, essential, dynamic role is more often than not taken for granted. Ironically, that role is crucial to the uncountable day-to-day functions that make you human enough to ignore them, like your agency, perception~action, thought, intention and movement. Information that is meaningful and specific to a system's Coordination dynamics (CD) is called functional information (FI). In the context of the Coordination Law, coordination patterns and modes expressed in a given moment are a function of heterogeneity and coupling strength of individual coordinating elements, as well as fluctuations. To the extent that these basic control parameters are in turn affected, adjusted, or tuned by other sources both internal (e.g. from memory) and external (e.g. from the environment), information becomes functional. Functional information is capable of altering or modifying basic coordination patterns, delaying their appearance, stabilizing and destabilizing them. Functional information is an essential complementary aspect of Coordination Dynamics.

The creation~destruction of functional information occurs in the metastable mode of CD, exactly where your *squiggle sense* is active, the result of the twisting, streaming, *squiggle* dance of integrating~segregating tendencies. Among other sentient miracles, this enables you to have thoughts and actions in the first place, and for them to be creative, anticipatory, improvisational, and intelligent. The creation~destruction or 'flux' of functional information informs, modifies, and guides the coordination essential for your self-awareness, agency, and thinking. And all of it, the complementary nature, your brain~mind, *squiggle sense*, the creation~destruction of functional information—arise from the *squiggle* sea of metastability!



The Metastabilian says: I'm a dissipative, dynamic self-organizing, synergetic system called a human being. As such, my very existence, behavior, health, survival all follow the Coordination Law. My dynamical landscape entails four universal coordination modes: uncoordinated, monostable, multistable and metastable. Of those, only the multistable and metastable modes are flexible enough to produce my higher sentient functions. But the crucial creation~destruction of functional information that informs, modifies, and enables my agency, the ability to guide my self-awareness, thought, coordination and *squiggle sense* occurs via my metastable mode. By realizing, understanding, appreciating and acting upon the idea that my metastable mode plays this essential role, I've become a metastabilian...

Related squiggles: emergence~disappearance, recruitment~annihilation, dwelling~escaping...

48 Of States and Tendencies

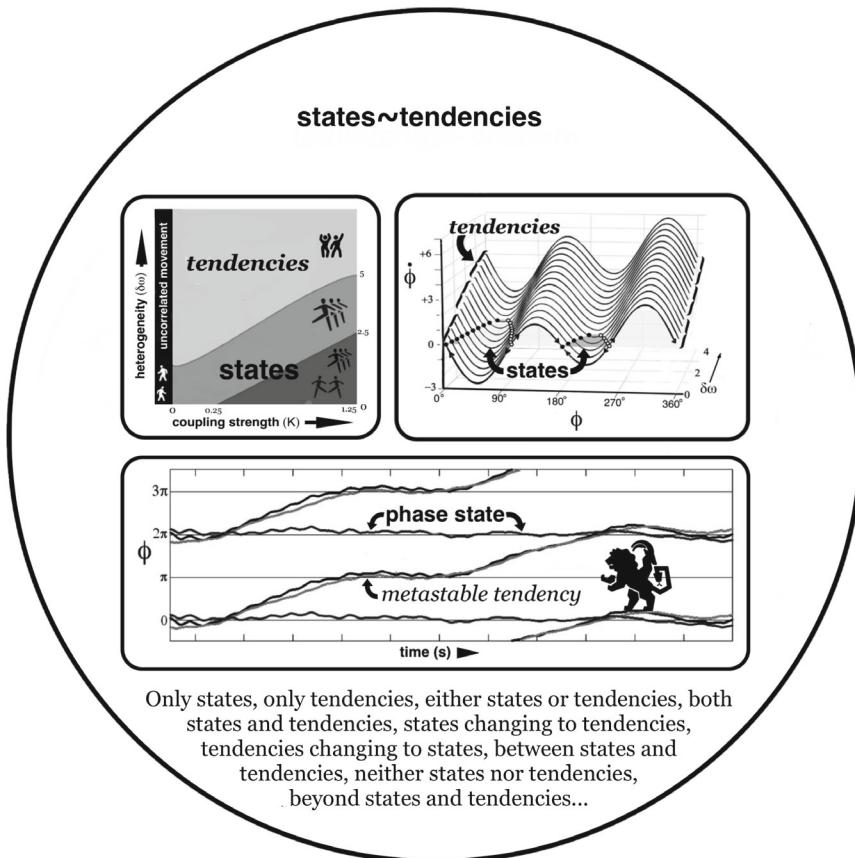


What was so odd about the coexistence state is that two seemingly incompatible forms of behavior...were present in the same system at the same time—Yoshiki Kuramoto

You are a complex dynamic synergy of synergies: a wondrous spatial-temporal orchestration, an exquisite combination and composition of matter and energy, a coordination of levels organized as coexistent interwoven dynamical landscapes, doing uncountable multifaceted coordinations simultaneously. So it is with humanity: 8 billion individual human beings, each trying to survive and prosper in an ever changing natural and social environment. There's so much complexity happening at once, it seems impossible to comprehend. Yet, Coordination Dynamics (CD) and your *squiggle sense* can help you comprehend it. Remarkably, CD's dynamical landscapes contain multiple states, transitions and coexisting tendencies, dwelling and escaping, individuals expressing themselves as autonomous entities at the same time as cooperating together. Each synergy operates in its individual dynamical landscape as well as participating in other collective dynamical landscapes. Stable states and transient tendencies occur at the same time in the same system!

Coordinated behavior in which states and tendencies co-occur has been dubbed 'chimera' (after the hybrid creature in Greek mythology). Dynamic chimera are inevitable in the synergies of CD because the coupling among elements of synergies can be nonlocal as well as local, weak in some places and strong in others. A closer look at iconic CD experiments which studied the interplay of the coupling between the hands and sensory input from the environment revealed the empirical footprint of chimera—(mixed) dynamics. Results clearly showed that *both* multistable states and metastable tendencies are part and parcel of the basic repertoire of human behavior.

Dynamic chimera offer a way to study both integration and segregation at once, an important advantage when it comes to understanding complex systems like your brain-mind. The key point is that two seemingly contrary kinds of behavior, namely multistability and metastability, coexist in the same system at the same time. Chimera, thus, are a dynamic signature of the fundamental multistable-metastable *squiggle* that sits at the very heart of your *squiggle sense*. But hold on. You likely have noticed already that in chimera, metastability is just one aspect of the metastable-multistable *squiggle*. Could this mean that metastability, the very source of the *squiggle, squiggles* with itself?



The Metastabilian says: I am a complex system, my brain-mind and body-mind is a synergy of synergies, an exquisitely heterogeneous combination and composition of levels, organs, subsystems, cells, organelles... all of which result in myself, an individual human being. I'm also one of 8 billion fellow human beings each unique and doing so many combinations of things. All of that complexity is not only accomplished by the capacity to move through and employ both states and tendencies of structure-function, but to employ them simultaneously on same and different levels. The phenomenon of dynamic chimeras demonstrates this amazing ability, which, after all, as mysterious as it is to comprehend...makes *squiggle sense!*

Related squiggles: hierarchy-heterarchy, multistability-metastability synergy-resonance...

49 Of Accommodation and Assimilation

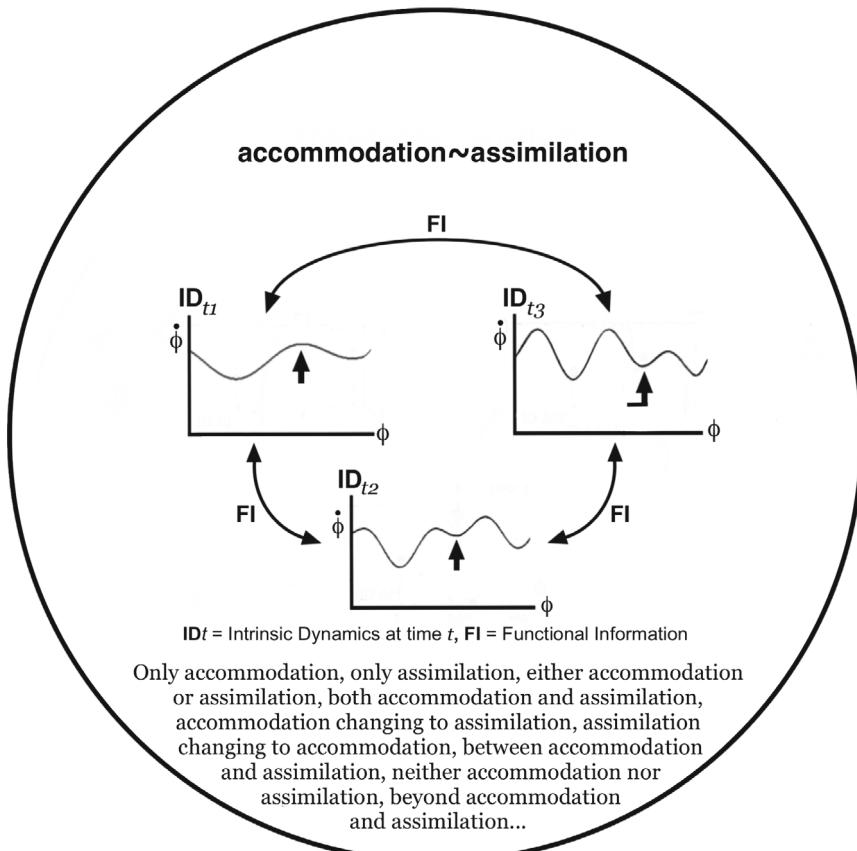


Every acquisition of accommodation becomes material for assimilation, but assimilation always resists new accommodations—Jean Piaget

At the psychological level, accommodation means a flexible tolerance of your brain~mind for novel dynamic coordination patterns. Assimilation means merging and reconciling novel input within a preexisting synergetic milieu, the evolving dynamical landscape or intrinsic dynamics. In Coordination Dynamics (CD), the *squiggle* dance of accommodation and assimilation is understood as the acquisition and stabilization of functional information. Your multistable modes and phase transitions between them are well-suited to assimilation and the pattern stabilization necessary for you to adapt, develop, learn and evolve. At the same time stability, or cohesion of pre-established synergies, naturally resists new accommodations, protecting you from informational overload.

To become a Metastabilian, you must somehow assimilate information you are even now accommodating about your *squiggle sense*, the complementary nature and the metastable CD of your brain~mind. If and when you do, you'll have adapted and altered your dynamical landscape to be more adept at intentionally engaging your *squiggle sense*. As a result, you should be better able to navigate pathways through your dynamical landscape and the multiplicity of coordination patterns expressed by them. Hopefully, you'll become more sensitive to the information created in your metastable mode and more readily perceive and act upon the Complementary Code and its endless dances of metastable tendencies. Ironically, this will also alter your ability to accommodate~assimilate new functional information!

Now, the CD paradigm predicts that the efficacy of accommodation and assimilation depends upon your intrinsic dynamics, the ongoing status of your dynamical landscape and the flux of information impinging on it. But guess what? You are actually predisposed to accommodate and assimilate functional information about your *squiggle sense*, metastable mode and Complementary Code! Metastability and multistability are active, indispensable modes of your dynamical landscape. Further, the complementary nature presents you uncountable contraries for your *squiggle sense* to perceive and act upon. Thus, you already have everything you need to proceed! But will you actually accommodate~assimilate the functional information presented in these *squiggle* frames in a way that changes you, enables you to evolve and advance, explore and discover, acquire new skills and better navigate your life's trajectory? This is your Metastabilian's challenge. It is your *Squiggle* quest!



The Metastabilian says: How amazing it is to be aware of, engage and wield my *squiggle sense* of the complementary nature. It leads me to so many novel insights and opportunities, discoveries and advances. It even helps me begin to comprehend how my brain~mind accommodates~assimilates creation~destruction of functional information. In the process of accommodating~assimilating functional information, my entire dynamical landscape changes flexibly but lawfully. As a Metastabilian, I intend, engage and guide those new complementary acquisitions of accommodation, and assimilate them with surprisingly little resistance. After all, they're welcome *squiggle* dances of my metastable~multistable brain~mind, a sentient, synergistic dynamical landscape!

Related squiggles: tolerance~adaptation, learning~memory, interaction~intra-action...

50 Of Metastabilian and Metastabilion

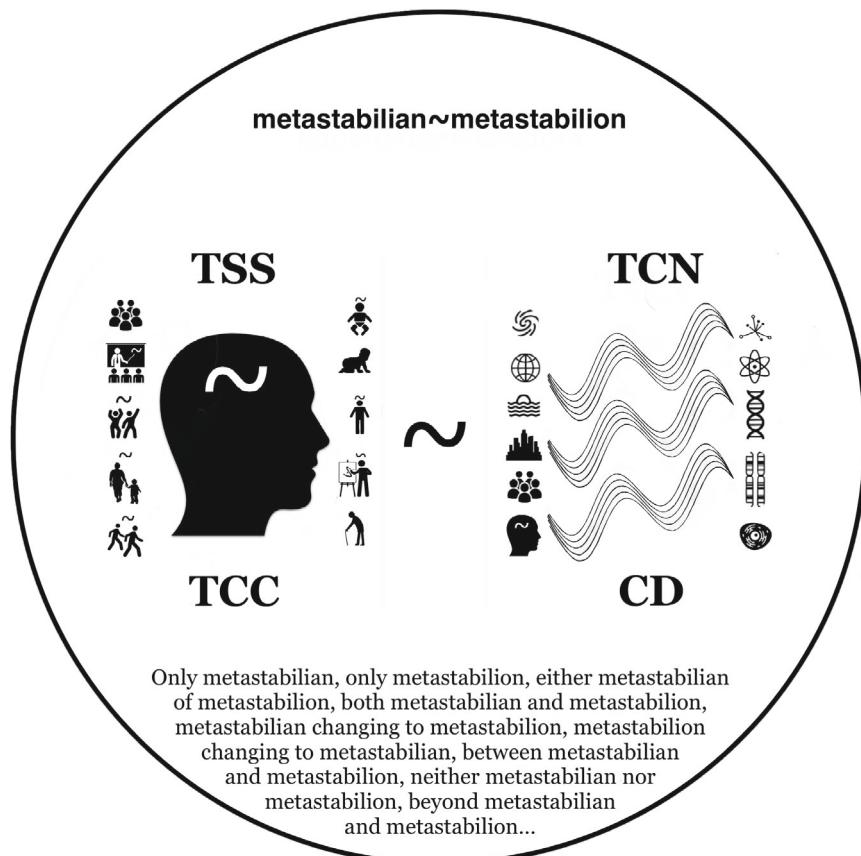


The world is simple and complex, logical and weird, lawful and chaotic. Fundamental understanding does not resolve these dualities. Indeed, it highlights and deepens them. You can't do justice to physical reality without taking complementarity to heart—Frank Wilczek

Hopefully, the *Squiggle* frames in this book will help you engage your *squiggle sense* and take the complementary nature to heart. Their gist and root messages are: (1) Nature, including human nature, is essentially complementary. (2) Human brain~mind includes a *squiggle sense*, a sixth sense of the complementary nature (TCN). (3) The complementary nature, *squiggle sense* and brain~mind are grounded in Coordination Dynamics (CD). (4) The *squiggle sense* arises from and operates in the metastable mode of brain~mind CD, one of its four archetypal dynamical modes of coordination. (5) A Metastabilian is one who intentionally engages and wields their *squiggle sense* of TCN via their metastable mode of brain~mind. (6) In the metastable mode, functional information, meaningful to brain~mind CD, is created~destroyed.

As a Metastabilian, you use your *squiggle sense* of TCN~CD to discover, explore, invent, create and solve problems in your life pursuits and the world around you in as many contexts as possible, whenever and wherever you can. This activity, called The Metastabilian Movement, is already leading some pioneers to new insights in diverse fields of interest and expertise. As a Metastabilian, you can use your *squiggle sense* to join the *squiggle* quest, namely the pioneering effort to explore, study and comprehend Metastabilion—“*the set of any and all unique complementary metastable tendencies, or squiggles that comprise the complementary nature.*” It’s exciting to contemplate and anticipate the fundamental discoveries, inventions and innovations of the twenty-first century and beyond that will come from its exploration. One that’s resulted in the *squiggle frames* of this volume is the discovery of the Complementary Code of CD. But there are untold more.

As a Metastabilian, your *squiggle sense* helps you move beyond fixated, divisive, polarized, intransigent, intolerant, hubristic thinking and actions that continue to plague humanity. You appreciate that no single polarized perspective is ever permanent, nor is it adequate to capture the reality of the world on its own. By shifting to your metastable mode, you are better at transcending fixation, making discoveries and innovations in all aspects and contexts of your life. The time is ripe for you to engage and wield your *squiggle sense*, to explore Metastabilion and produce and pursue the metastable trajectories of your own metastabilian movement. You might even use them as a platform on which to foster your individual enlightenment and social harmony grounded in TCN~CD. You could save the world!



The Metastabilian says: It becomes ever more familiar, the onset of my metastable mode and *squiggle sense*. I sense the ebbing-flowing flight-perching, the relative phasic dances of the complementary nature. I experience the twinkling flux of functional information in my metastable mode. It heightens my awareness in so many different ways-means, piquing my curiosity-imagination and action. How vast is Metastabilion, this cosmic, metastable ocean of complementarity? Imagining it helps me transcend the limiting narrow-mindedness of polarized, either/or thinking-doing. Unfettered from the habit of dwelling in mutually exclusive duality, I advance and evolve in my thoughts, works and deeds. As a Metastabilian, I'm an intentional agent of my *squiggle sense* of the complementary nature, of my Metastabilian movement...

Related squiggles: metastability-complementarity, creation-discovery, TCN-TSS...

Coda—The Meaning of Mtsbwy

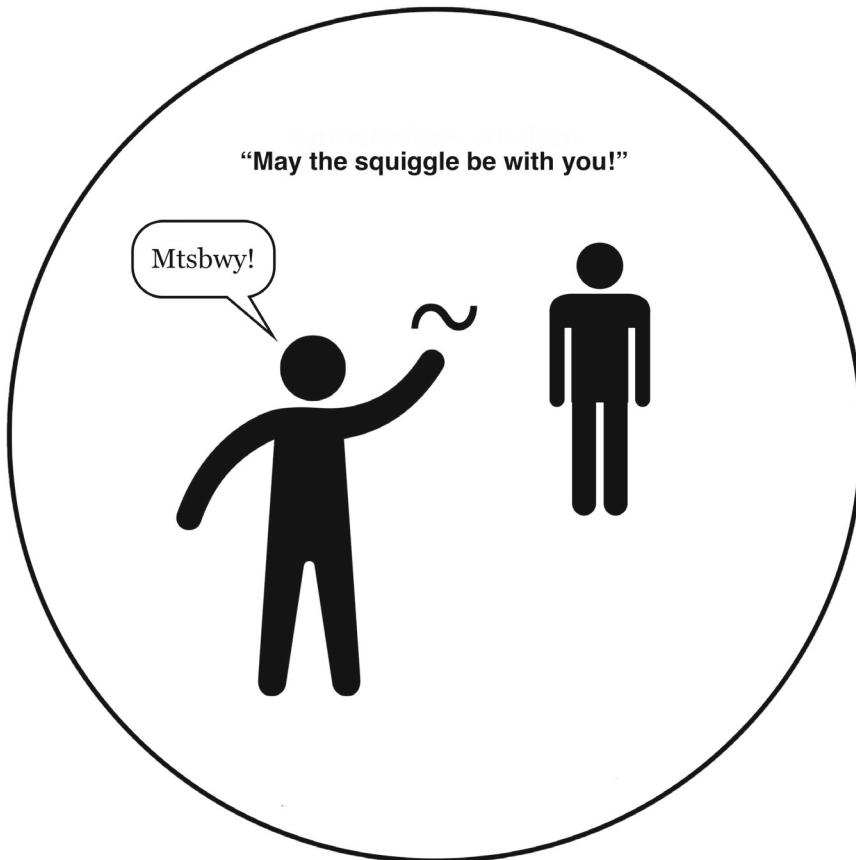


It seems we have found a way at last to provide a scientific grounding for both polarization and reconciliation, which though discernible, differentiable aspects, are nonetheless inextricable.—J. A. Scott Kelso and David A. Engstrøm

Mtsbwy is an acronym that stands for “May the squiggle be with you”. Mtsbwy is a Metastabilian greeting, a way to express your awareness, interest and appreciation of the *squiggle sense* of the complementary nature (TCN) to yourself and to others. You can think it, say it, write it and also ‘sign’ it simply by drawing the *squiggle* sign in the air. Mtsbwy means you are aware of TCN, your *Squiggle Sense* of it and the Coordination Dynamics (CD) that grounds it in science. Mtsbwy means you appreciate the significance of the Complementary Code of CD, those critical *squiggles* necessary for all levels of your synergetic being~becoming. Mtsbwy means you know about the Coordination Law equation, and the dynamical modes of dynamical landscapes—yours as well as other people’s, groups and systems. Mtsbwy means you understand that functional information can sculpt dynamical landscapes and be sculpted by them, how incredibly flexible life in the complementary nature really is.

Mtsbwy in its delivery to others means you wish to share this novel perspective, outlook, knowledge~wisdom, in the hope that it will help you and those you say, write or sign it to transcend narrow-minded, limiting, either/or, “my way or the highway” thinking~behaving. Mtsbwy is a reminder to let go of common yet erroneous belief~dwelling in absolutes, permanent states, fixed points, rigid ideals. Saying, writing or signing Mtsbwy means you want to explore, navigate, appreciate and express the complementary nature of life via *the squiggle sense* of your metastable brain~mind. It means that you understand that you and your world are neither purely analytical nor empirical, individual nor collective, bound nor free. TCN grounded in CD is too dynamical, too flexible for such rigid idealizations.

Mtsbwy means you sense TCN of dualities and contradictions. Mtsbwy is a clarion call for all people to embrace, appreciate and wield their vital metastability, or in other words—become Metastabilian. Mtsbwy carries with it a fond and exciting hope, the prospect of an incalculable feat of civilization yet to be achieved in history, a creative~evolution of sentient advance, a novel way forward. Just as CD has been shown empirically and theoretically to transcend different kinds of things, processes, events, so the *squiggle* symbol is universal. *The Squiggle Sense* cuts across all languages, cultures, nationalities, religions. It is the gateway, a new universal language that embraces yet transcends contradiction, dichotomy, and polarities. And now we say to you as hopefully you will say to others—Mtsbwy! May the *squiggle* be with you!



The Metastabilian says: My *squiggle sense* is awake. It gives me so many deep and novel insights into myself and my world. So what comes next? I have my companion, *The Squiggle Sense, Sixth Sense of The Complementary Nature and the Metastable Brain-mind* to inspire me to practice returning to my metastable mode as much as possible. But what more? One thing is sure—I'm not alone: The individual~collective complementary nature says so! There are more Metastabilians out there. Some know who they are, some don't. Yet. How can I meet and greet them? I can say "Mtsbwyl! May the squiggle be with you!" and draw a *squiggle* in the air. What would it be like to introduce someone to their *squiggle sense* for the first time? What would it be like to meet other Metastabilians? What might come of sharing appreciation of the complementary nature between myself and other Metastabilians?

Related squiggles: knowledge~wisdom, self~other, individual~society...

Readings for the Squiggle Sense



This is a brief, highly personalized reading list intended for those who wish to delve further into Coordination Dynamics, metastability, The Complementary Nature and related matters. Most of the material is in the form of Reviews/Encyclopedia Articles, though some key research articles are also included. The order is chronological. The work of many others, of course, is cited in these papers

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