



laetus in praesens

Alternative view of segmented documents via Kairos

27 October 2004 | Draft

Functional Complementarity of Higher Order Questions psycho-social sustainability modelled by coordinated movement

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This paper is an annex to *Engaging with Questions of Higher Order: cognitive vigilance required for higher degrees of twistedness* (2004).

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Introduction

The semantics and pragmatics of questions have long been the object of linguistic exploration, as usefully reviewed by Judith Blanchette (*Questions in the Online Learning Environment*, 2003) and by Michiel Borkent and Riemer van Rozen (*On logic and questions in dialogue systems*, 2004). Several types of questions in English are distinguished: yes/no questions, WH-questions, alternative questions, tag questions, and intonation questions.

There is an extensive literature on those referred to as "WH-questions" (see Robert D. Van Valin, Jr. *The Acquisition of WH-Questions and the Mechanisms of Language Acquisition*). These are notably considered of importance in language teaching. The set consists of questions such as: Who, Why, Where, What, How, When, Whether, Whither, Whence. All these forms are ultimately derived from an Indo-European root (*kwo-*), a stem of relative and interrogative pronouns. In Latin and Romance, the corresponding forms generally begin in "qu-" (e.g. Latin *quid, quod*, French *qui, quoi, quand*, etc).

Semantic interrelationships between WH-questions

The semantic relationships between WH-questions do not appear to have been explored, the main focus being on pragmatics, intonation, and comparative syntactical issues across languages. For example, Lisa Lai Shen Cheng (*On the Typology of WH-Questions*, 1991, 1997) proposes that the typological distinctions among languages with respect to the formation of WH-questions can be attributed to the availability of question particles and the properties of WH-words. Unfortunately, the problem of identifying question type has long been recognized as a difficult one.

Michiel Borkent and Riemer van Rozen (*On logic and questions in dialogue systems*, 2004) move towards such an exploration through logical relationships in a "logic of questions" (analogous to a logic of propositions). Their interest is in how a logic of questions can contribute to the analysis of questions in dialogue systems and their improvement -- in order to "lift the work in this field to a higher level".

Hui Yang, et al. (*Modeling Web Knowledge for Answering Event-based Questions*, 2003), in discussing the correspondence of WH-questions and event elements, conclude that a QA event shows great cohesive affinity to all its elements and the elements are likely to be

closely coupled by this event:

- Who/Whose/Whom: Subject, Object
- Where: Location
- When: Time
- What: Subject, Object, Description, Action
- Which: Subject, Object,
- How: Quantity, Description

But it might also be asked whether there are other kinds of WH-questions characteristic of other epistemological mindscapes in the light of the arguments of Magoroh Maruyama and others (see *Systems of Categories Distinguishing Cultural Biases*, 1993). Irrespective of the syntactic structure and the use of intonation in questioning, which are a major focus of linguistic research, there seems to be an interesting assumption that the set of WH-questions (however constructed) is **semantically** invariant across languages -- perhaps as a feature of a universal grammar. This would be curious given the recognition of the existence of languages with minimal distinction of numbers and colours -- and richer distinctions with regard to features characteristic of their environment (eg snow, etc).

Although interrelationships between them do not however appear to have been directly addressed, the *Principia Cybernetica* integrates them -- in relation to **eternal philosophical questions** -- into the articulation of a complete world view. It is also instructive to reflect on the ways in which the dynamics of the "Garden of Eden" -- as an archetypal epistemological space -- can be framed in terms of the complementarity amongst such "WH-questions".

Given their fundamental role, as a semantic or cognitive set, the concern here is the possibility that the WH-questions may be interrelated in a particularly interesting way. This is seen to be of relevance to:

- strategic decision-making for individuals or groups and the questions appropriate to critical thinking and the vigilant avoidance of dysfunctional groupthink
- self-reflexiveness in navigating reality (especially the experiential dimensions), whether understood as philosophy (elucidation of alternative epistemological frameworks) or as engagement in an alternative lifestyle
- engagement on any (vision) quest (especially given the relationship of "quest" to "question")
- dialogue between parties with radically different perspectives (whether ideological, political, epistemological, etc)
- dialogue between perspectives of higher and lower complexity

The relationships between the WH-questions might usefully be understood as a form of cognitive knot -- different threads weaving to form a cognitive fabric (a "magic carpet"). The threads involve a degree of entrainment / entailment / enaction / engagement with reality. Each is associated with a different kind of dynamic connection or framing: the "why energy", the "who energy", the "where energy", the "what energy", the "how energy", etc. However it is highly probable that the terms (or their syntactic equivalents) are used in discourse in ways that blur recognition of the unique functions to which they relate. Some terms using one form may in fact reduce to another: "**How** long before it rains?" may be reduced to "**When** will it rain?" The terms may therefore be rough pointers to a semantic or cognitive set which is the focus of what follows.

Engaging with tendencies to twisting movement -- insights from helicopter control

An interesting approach to the nature of the integration performed by any practitioner of movement is offered by the work of [Arthur Young](#) in *Geometry of Meaning* (1978). His insights derived from his engagement in the development of the Bell helicopter. His learnings developed from reflection on how such a vehicle could be navigated in three dimensions in a controlled manner -- responding to the challenging tendencies for the vehicle to twist out of control in various ways. This could be seen as the basis for a useful articulation of the challenge for any body to navigate in a complex space. Such knowledge is the basis for successfully undertaking challenging sports involving a high order of kinetic intelligence.

Young presented the generalization of his insights as an explication of the learning-action cycle, expressed in 12 phases. He associated each of these with one of 12 measure formulae fundamental to dynamics of piloting a vehicle. A commentary on learning cycles is provided elsewhere (*Cycles of dissonance and resonance*). His model has been tentatively adapted and developed, notably in relation to *Clues to integrating movement through kinetic intelligence* (in *Navigating Alternative Conceptual Realities: clues to the dynamics of enacting new paradigms through movement*, 2002):

- *Typology of 12 complementary strategies essential to sustainable development*
- *Typology of 12 complementary dialogue modes essential to sustainable dialogue.*

In Young's original presentation, the vehicle was a helicopter. In the more general case it could well also be applied to the human "vehicle" in the Buddhist sense -- or any conceptual vehicle. In marked contrast with the classic static presentations of virtues and vices in any culture, his approach introduces the dimension of time that is central to movement in different ways. It emphasizes the way in which movement is coordinated -- and how attributes such as "momentum" are used in complex manoeuvres by practitioners. From such a perspective, an attribute like "inertia" may be of considerable positive significance -- in contrast with its negative characterization as vice (cf in Christianity) or fetter (cf in Buddhism) of "sloth".

As briefly expressed elsewhere (see *Navigating Alternative Conceptual Realities: clues to the dynamics of enacting new paradigms through movement*, 2002), there is a lack of operational specificity to the various static "guidelines" to movement in semantic space. But as those participating in many sports would probably argue, it takes experience to learn what subtle experiential meaning is associated with attitudes appropriate to any "code words" about improved performance. Much may be achieved with inappropriate attitudes, but they do not raise the level of performance beyond a certain degree. Ultimately the person is judged as lacking something subtly associated

with "style", "élan" and "flow". Basically the performance is not sustainable. In this respect the relationship, in Buddhist meditation practice, between the "hindrances" and "fetters" encountered, and the articulation of necessary values, is somewhat more explicit.

Measure formulae as the basis for a semantic template

WH-questions (Where, Why, When, How, etc) are basic to piloting a vehicle. A pilot must constantly ask and answer such questions, whether consciously or unconsciously. What is required is a fundamental way of interrelating the WH-questions and determining how they are necessary in order to navigate other spaces -- including that of experiential reality. A valuable lead in this is the work of Arthur Young (*The Geometry of Meaning*, 1978) on measure formulae and the learning/action cycle (despite the reservations of Frank Barr: *Toward a Solution of the "Big Questions"*, 1988). His work is particularly valuable because of the mindset he had to cultivate in developing the Bell helicopter -- a fundamental challenge to controlled movement.

For Young, in discussing the "categories of knowing represented by measure formulae", he argues (pp 20-21):

What are these measure formulae, position, and its derivatives, velocity and acceleration? Are they just the simple "physical quantities" as they are referred to in textbooks?

Not so. closer examination reveals fundamental *qualitative* differences between them...Position can only be *observed* visually or by less direct processes. Velocity is an intellectual abstraction: it cannot be known from direct experience. It must be computed. To know velocity, we must make two observations of position, determine their differences, and divide the time elapsed, thus obtaining a *ratio*... Acceleration, however, is felt. For example, when an elevator suddenly starts down, you *feel* it.... [*emphasis in the original*]

Young continues in a discussion of "generating other measure formulae" (pp 32-33):

In the pursuit of meaning, the measure formulae are invaluable because they replace words...The measure formulae, as we have seen in the case of length (L) and its derivatives, are more explicit than words in that they define operations, like the operation of the derivative. Thus they anticipate the aspects or categories that we may expect a situation to have...The measure formulae are the outcome of centuries of struggle on the part of physical science to arrive at a set of terms that can be formulated in such a ways as to leave no vagueness, no ambiguity. They describe the skeletal anatomy of all science, and even anticipate modern discoveries...

The measure formulae we have considered -- position and its derivatives -- are given in terms of two variables, length (L) and time (T). These two variables, more correctly referred to as parameters, together with a third, mass (M), are the basic ingredients of physics, more basic than the formulae, as they are fewer in number; the formulae are combinations of these parameters...[as].. the "undefined terms," the fundamental ingredients from which all measure formulae are constructed.

Young then demonstrates the generation of other measure formulae (see Table), noting that of the twelve, 10 (recognized by physics) are used to analyze the dynamics of a moving body, whilst 2 are "not presently recognized in physics textbooks, but used in engineering".

Generation of Measure Formulae (according to Arthur Young)				
Group I		Group II	Group III	
L = position	x M =	ML = moment	x L =	
L/T = velocity		ML/T = momentum		ML ² = moment of inertia
L/T ² = acceleration		ML/T ² = force		ML ² /T = action (rate of change of inertia)
L/T ³ = control		ML/T ³ = mass control		ML ² /T ² = work
			ML ² /T ³ = power	

Qualitative operational relationships associated with learning cycle

In seeking to use this as a possible template for recognizing the semantic relationships amongst the WH-questions, the point to be made is that such questions are, to an important degree, focused on orientation and movement in **semantic space-time**, whereas the Young framework builds on the challenge of moving in **physical space-time**. The WH-questions may thus be understood as different kinds of informational interaction with the semantic context that are necessary for controlled movement in that context. Of particular significance, in the interaction through such questions, is the process of learning through which questions are refined -- hence their current relevance to information retrieval system design.

Young himself focuses at length on the nature of the learning cycle in elaborating what he terms a "Rosetta Stone" of meaning. This is "not just a translation of meaning, but is a generation of meaning. It is the relationships between the words we must use, not their definitions, that give them their meaning" (p. 38). With respect to the learning cycle, he distinguishes four basic categories of **act**, **relationship** and **state** that he interrelates as follows:

Basis of Rosetta Stone of Meaning (according to Arthur Young)		
Relationship	Act	State
<i>impulse (purpose)</i>	<i>spontaneous act</i>	<i>being</i>
<i>faith</i>	<i>change (reaction)</i>	<i>transformation</i>
<i>knowledge (form)</i>	<i>observation</i>	<i>significance</i>

He addresses the challenge of relating this learning cycle to the set of measure formulae on the following basis:

We shall use the cross axis as a format for analysis to bring out the meaning implicit in the angular relationship between the terms. Recall that factors at opposite ends of an axis are mutually opposed, that those at right angles to one another are independent, and that rotation signifies change in time. (p. 41)

Rosetta Stone of Meaning
 Correlating physical quantities with English meanings
 (from [Arthur Young](#). *Geometry of Meaning*, 1978, p 49)

Cognitive instruction set for a semantic vehicle

The table below uses a clumsy array of approximate terms to identify a possible set of complementary ways for the "driver" of an existential "all-terrain vehicle" to "handle" the relationship with the environment. Each mode suggests a different way of using energy to act coherently, although all are necessary according to the nature of the challenge. The presentation is distorted because it underemphasizes the ways in which the challenge from the environment may invite a gentler and more seductive response than is suggested by the metaphor of driving an all-terrain vehicle -- a metaphoric trap with which the world is now all too familiar.

Key Insights from Young's Learning-Action Cycles				
		Certitude Confidence	Boundary Delimitation	Relationship
A	Static	Observing	Being constrained	Possessing property
B	Velocity	Adapting	Tracing / Marking / Explaining	Taking possession / Occupying / Taking over
C	Acceleration	Initiating	Forcing	Psyching up / Talking up / Entraining
D	Exemplifying	Controlling transformation	Responding through discipline	Integrating identity / Embodying

Set of measure formulae as a template for WH-questions

Given this richly integrated fundamental semantic template, the challenge is whether and how the WH-type questions might map onto it. The key issue is whether each of Young's 12 categories implies a particular ("archetypal") style of WH-question. The approach to this challenge here builds on several earlier attempts to interpret/adapt the Young template for other purposes. (See: commentary on learning cycles in *Cycles of dissonance and resonance*; also *Characteristics of phases in 12-phase learning / action cycles*; also adaptation to *Typology of 12 complementary strategies essential to sustainable development*; and *Typology of 12 complementary dialogue modes essential to sustainable dialogue*).

In this light the approach to such a mapping of WH-questions may be made tentatively in the following table.

Possible WH-questions challenging categories of Arthur Young's "Rosetta Stone"			
Young's categories		Tentative attribution of significance	
Groups	Categories	Clues / Question "flavours" challenging categories	Possible WH-questions
State	<i>being</i>	Who am I? How can I be (myself)?	Who? How?
	<i>transformation</i>	How can I change? How long? When did this arise? When will it end?	How? When?
	<i>significance</i>	What does it mean? How important is it? What did I achieve?	What? How?
	<i>establishment</i>	How do I establish myself? What have I achieved? How do I sustain my position?	How? What?
Act	<i>spontaneous act</i>	Why do I do that? Where am I going? What am I getting into?	Why? Where? What?
	<i>change (reaction)</i>	How should I react/adapt? What should I do?	How? What?
	<i>observation</i>	What can I see? Where am I?	What? Where?

	<i>control</i>	How do I control my situation? Who is in control? What should I do?	How? Who? What?
Relationship	<i>impulse (purpose)</i>	Why would I be this? What is my purpose? Which way should I go	Why? What? Which?
	<i>faith</i>	Who should I believe? Who said so? Why do I believe? How long should I believe? Who made the world?	Who? Why
	<i>knowledge (form)</i>	What is the relevant pattern? Who knows? What do I need to know?	What? Who?
	<i>fact</i>	Why is it true / real? What next? Who said so?	Why? What? Who?

Exploratory application of WH-questions to Arthur Young's "Rosetta Stone"						
	How?		Why?		Who?(Whose?, Whom?)	
	Group I: Act (C)		Group II: State (F)		Group III: Relationship (M)	
Where? (A)	L = position	<i>observation</i> [Who?/How?]	ML = moment	<i>significance</i>	ML^2/T^3 = power	<i>knowledge</i>
Which? (W)	L/T = velocity	<i>change</i>	ML/T = momentum	<i>transformation</i>	ML^2/T = action (rate of change of inertia)	<i>faith</i>
When?(F)	L/T^2 = acceleration	<i>spontaneous act</i>	ML/T^2 = force	<i>being</i> ["player"]	ML^2 = moment of inertia	<i>impulse</i>
What?(E)	L/T^3 = control	<i>control</i>	ML/T^3 = mass control	<i>establishment</i>	ML^2/T^2 = work	<i>fact</i>

	Present	Future	Past
	Means	Motive	Suspect / Accomplice
	How?	Why?	Who?
Where? (Where to go?, Where is it from?)	<i>Observation</i> [Where/How] Where am I?	<i>Significance</i> [Where/Why] Provenance: Where does that come from? Why is it significant?	<i>Knowledge</i> [Where/Who] Where is the knowledge? Who has it? Who discovered it?
Which? (Which way? Which to choose?)	<i>Change</i> [Which/How] Which response? How to respond?	<i>Transformation</i> [Which/Why] Which transformation and why?	<i>Faith</i> [Which/Who] Which belief? Who to believe in? Who believes?
When? (When to start? When to stop?)	<i>Spontaneous act</i> [When/How] When to act? How to act?	<i>Being</i> [When/Why] When to be like that? Why be like that?	<i>Impulse</i> [When/Who] When to start? Who is so impelled? Who to impell?
What? (What is it? What to do?)	<i>Control</i> [What/How] What do I do? How do I do it?	<i>Establishment</i> [What/Why] What have I done? Why have I done it?	<i>Fact</i> [What/Who] What evidence is this? Who says so?

Challenge of interpretation and comprehension

The preceding tables pose fundamental challenges to comprehension which are addressed by Arthur Young's more detailed arguments regarding their two-fold, three-fold and four-fold dimensionality. The basic challenge is the distinction between:

- interrelating categories of action experience (and their associated learning cycles) into explanatory tables (as above) and
- comprehending and embodying the relationship between the varieties of experience so categorized

This is the distinction between memorizing a detailed manual on flying a helicopter and the actual ability to coordinate the different cognitive operations essential to that process. This might be understood in terms of the term "operacy" as promoted by Edward de Bono:

In education we are concerned with literacy and numeracy. That leaves out the most important aspect of all, which I call "operacy". The skills of action are every bit as important as the skills of knowing. We neglect them completely and turn out students who have little to contribute to society. [\[more\]](#)

In exploring the above tables, the challenge is to **avoid being locked into a particular style of question** in relating to any context,

whether:

- by cell: how/when, or who/what, etc
- by column: how, why, or who
- by row: where, when, which, what

This applies in particular to use of the same style of questioning in exploring the above pattern of questions! The perspective called for (in piloting a "cognitive helicopter") is the ability to shift appropriately between the question -- a detachment from any one of them as a preference (like preferring 2nd gear in an automobile). Piloting is the ability to shift appropriately. [black helicopters]

One way to characterize the trap is to compare the form of the table to the frontal view of many multi-storied buildings. The eye moves most readily over the alienating rectangular patterns of that form. This has very little to do with any cognitive dimensions which are portrayed and interrelated through that form. This is best recalled by recognizing the fundamental nature of questioning and the dynamic application of questions in areas such as:

- philosophy: who am I, etc
- evidence in science: what is it, how does it work
- evidence in crime: how, why, who, etc in relation to identification of means, motive and opportunity with regard to suspects
- choice as a consumer: the complex process of determining needs, and selecting products to meet those needs, on a daily basis
- acquiring information: especially through web retrieval systems using search engines, and the associated learning processes through which searches are refined
- relationships: will s/he, won't s/he?
- self-development: integrating and embodying insights emerging from a succession of action learning cycles and reflection on life experience (as exemplified by the statement "an unexamined life is not worth living")
- narrative coherence: understood as an interwoven pattern of basic questions and answers (interlocking cycles of action and learning) that derives its interest from a transformation and reframing of perspective

Another aspect of the trap is evident in the case of proprietary systems of categories by which questions and answers are configured. The current market-oriented approach to exploitation of knowledge and insight results in many such frameworks being copyrighted, or restricted to use under license. An example is the *Myer-Briggs Type Indicator*® (MBTI®) a registered trademark of [Consulting Psychologists Press, Inc.](#), the publisher of the MBTI instrument. What can be copyrighted does not hold the dimension essential to new understanding -- but could essential questions or answers be copyrighted?

As stated by [Alfred Korzybski](#) (*Science and Sanity*, 1933): "A map is not the territory it represents, but if correct, it has a similar structure to the territory, which accounts for its usefulness" -- a key understanding for Neuro-Linguistic Programming (NLP) [[more](#)]. This challenge to the diffusion of knowledge is discussed elsewhere (*Future Coping Strategies: Beyond the constraints of proprietary metaphors*, 1992)

The quality denoted by the label associated with the cell of a table above is a dynamic resolution of two questions. The label points to a dynamic answer, holding (or embodying) the unresolved (unanswered) dimensions of the question constituted by a strategic dilemma in piloting the cognitive vehicle. The quality associated with the cell does not bring closure to the questions associated with it. The "focus" is "in" rather than "on" the dynamic -- it is not a static focus.

Transformational questioning

According to Michiel Borkent and Riemer van Rozen (*On logic and questions in dialogue systems*, 2004), the "things all questions have in common" are:

- Questions must have answers.
- Question and their answers bear relation to each other
- Answers to why where who what how questions are of a form different from the yes-no form.
- Questions are posed to gain knowledge.
- Questions exist in dialogues, and must be spoken out loud.

The emphasis in many such conventional approaches to the study of questions and answers ("Q&A") is in the direct connection between question and answer. Specific questions imply specific answers. A question that cannot be answered is not a proper question. Answers are designed for specific questions (FAQs).

Such a Q&A framework does not respond to many subtler existential questions that emerge in navigating the cycles of daily life -- for which "satisfactory" answers may be sought in distraction (entertainment, substance abuse, etc), consumerism, religion or sex. This recalls the adage: "For every complex problem, there is a solution that is simple, neat, and wrong". Some questions do not go away -- because the answers available are not satisfactory. This is most obvious for many young people in the case of what to do with one's life. It is evident to all in relationships -- where the response to a key question may be "maybe".

The existential nature of the quandry is well-illustrated by the function of a koan posed to a student by a Zen master. The koan is indeed a "question" which can be asked: "What is the sound of one hand clapping"? There are many possible "answers", which although credible are "wrong". The essential role of the koan is to evoke a different attitude that effectively reframes the question and any possible answer. The answer is in the transformation of perspective -- a learning that is quite distinct from what is conventionally understood by the retrieval of information (as with a riddle).

The contrast can perhaps be most briefly described as between an immediately comprehensible answer and one that requires learning.

What we need to understand may only be expressible in a language we do not know.

"Pathology" of Q&A: problematic answers to single-mode questions

Through many publications, Edward de Bono has focused, notably in corporate strategic environments, on the challenge of transcending thinking traps with more appropriate and challenging questions. He has even recommended the use (in English) of a new operator "po" as a means of transcending "yes and no" mentality (Edward de Bono. *PO: beyond YES and NO*. London, 1972; see discussion in [Categorical Straightjackets PO: A suggestion for a de-patterning device for international organization descriptions](#), 1974).

Elsewhere de Bono has explored the use of sets of cognitive "hats" and "shoes" (*Six Thinking Hats*, 1987 and *Six Action Shoes*, 1991). The "shoes" are notably in relation to his understanding of operacy -- which would be a key to the operation of any cognitive helicopter. As he puts it: "Most executives, many scientists, and almost all business school graduates believe that if you analyze data, this will give you new ideas. Unfortunately, this belief is totally wrong. The mind can only see what it is prepared to see."

The "pathology" of a mono-modal thinking approach might be understood in terms of so-called "freaks":

- Control freaks
- Faith freaks (fundamentalists)
- Observation freaks (trainspotters, "twitchers")
- Action freaks ("action man")
- Being freaks ("hanging out")
- Establishment freaks (status)
- Change freaks
- Transformation freaks (self-improvement)
- Significance freaks
- Knowledge freaks
- Fact freaks ("trivial pursuit")

Existential dynamic in a "cognitive helicopter"

As noted earlier, the challenge of piloting a helicopter was the inspiration for Arthur Young's model -- used here to order WH-questions relating to movement in semantic space. Such are the cognitive challenges of helicopter movement that a study has in fact been made of a "cognitive helicopter" (A. Walsdorf, et al. *Cognitive Helicopter Cockpit: From Human Operator to a Cooperation between Man and Cognitive Assistant System*, Internationales Hubschrauber Forum 2000, Bückeburg). Of course the focus there is on the "helicopter", whereas here the concern is with "cognition".

WH-interactions with "reality", and how the latter is reframed and re-engaged by that process, might be understood as what being alive is all about. WH-interactions are what is happening moment by moment to sustain relationship with reality and be nourished by it. Those interactions are like a cognitive form of REM (rapid eye movement).

It would be very interesting to explore WH-interactions from a perspective of different kinds of meditation -- especially those so highly articulated by Buddhism. Meditation might indeed be understood as piloting a cognitive helicopter -- as "cognitive helicoptering". The higher disciplines of meditation purportedly involve engaging with reality so as to reframe the knower-known relationship. Who asks the questions? Who answers?

Ironically the term "helicopter" derives from the Greek adjective "*elikoeioas*," (Latin "*helix*") meaning spiral or winding and the noun "*pteron*," meaning feather or wing.

The ability of a helicopter to rise vertically and move in any direction is consistent with the freedom sought in many forms of meditation. Both "helix" and "wing" are significant metaphors in meditation. Again, the capacity to "hover" in place might be compared with the quality of detachment from mundanities -- as sought in meditation -- or the appropriate navigation of patterns of virtues and vices ([Navigating Alternative Conceptual Realities: clues to the dynamics of enacting new paradigms through movement](#), 2002). Insights of relevance are also articulated in relation to aerobatics (see [Why Hummingbird?](#), 2002). Arthur Young in 1946 moved on from his work on the helicopter to an interest in the psychopter -- the helicopter as a metaphor: "What is the Psychopter? It is the winged self. It is that which the helicopter usurped -- and what the helicopter was finally revealed not to be." (*The Bell Notes: A Journey from Physics to Metaphysics*, 1979). It might even be instructive to consider the parallels between the earliest efforts at helicopter design [[more](#)] and exploration of the psychological technologies of meditation.

This approach is also consistent with that of enactivism, and specifically the phenomenological explorations of Francesco Varela (*The Embodied Mind*, 1991) relating to embodiment as discussed elsewhere ([En-minding the Extended Body: Enactive engagement in conceptual shapeshifting and deep ecology](#), 2003).

The helicopter metaphor also points to the merit of considering the importance of "torque" in the psychological analogue -- especially since torque is essentially a "twisting" or rotational force ([Twistedness in Psycho-social Systems: challenge to logic, morality, leadership and personal development](#), 2004). It is the moment of a force; the measure of a force's tendency to produce torsion and rotation about an axis.

In the case of a helicopter, and in accordance with Newton's law of action and reaction, the helicopter fuselage tends to rotate in the direction opposite to the rotor blades. This effect is called torque. It is associated with the geometric center of the main rotor and results from the rotor being driven by the engine power output. It must be counteracted and or controlled before flight is possible and must be continually corrected during any manoeuvres:

Compensation for torque in the single main rotor helicopter is accomplished by means of a variable pitch antitorque rotor (tail rotor) located on the end of a tail boom extension at the rear of the fuselage. Driven by the main rotor at a constant ratio, the tail rotor produces thrust in a horizontal plane opposite to torque reaction developed by the main rotor. Since torque effect varies during flight when power changes are made, it is necessary to vary the thrust of the tail rotor. [[more](#)]

A form of "torque" has been considered of significance in relation to schizophrenia (T Blau. Torque and schizophrenic vulnerability: as the world turns. *American Psychologist*, 1977, 32, 997-1005). the question of "psychic torque" seems to have been explored by Eddie Oshins whose lifetime interest in martial and meditative arts was reflected in an experimental proposal for measuring certain forms of self-referential motion predicted by his theories. Through his [Quantum Psychology](#) project, he proposed a modification of the results of experiments with monkeys by A. P. Georgopoulos, which indicate neuro-correlates for mental rotations such as have been shown to occur in mental imagery by R. N. Shepard and colleagues. Oshins suggested a simple experimental adaptation from the [wing chun kuen](#) martial art's "siu niu tao form" to derive data supporting his hypothesis of a "psychic torque." [[more](#)]

The relevance of "torque" to any meditative "ascent" of a "psychopter" is suggestively indicated from a Zen perspective by Chuan Zhi Shakya (*Being a Good Shepherd and Being a Non-Shepherd*):

Non attachment is integral to Zen and if we foster it in our relationships with others we free ourselves, and others, from the emotional torque that all too often leaves us spiraling out of control. If we abide in the path of non-attachment, we won't get pulled into the tormented existence of the drug-abuser or the thief, and we'll be able to provide unbiased, selflessly motivated guidance when troubled people come to us for help.

A much more grounded insight into the relevance of vehicle driving to any understanding of navigation of cognitive spaces is suggested by the challenge of marketing vehicles, as in *Driving dynamics are a metaphor for contemporary lifestyles*:

Modern individuals want to drive actively, which can also mean fast, but not irresponsibly and always with the sense of having the vehicle completely under control. They want to enjoy a "sports-oriented" driving experience and feel the power in their vehicle.

Challenge of closure

Implicit in a focus on questions is a search for "closure". An answer provides a degree of closure -- effectively de-energizing or discharging the question. Paradoxically the "closure" provided by an answer may be in some cases characterized by an unusual form of "openness" -- acknowledged notably through the insights triggered in answering a koan. Curiously the "challenge of closure" is also of particular importance to Christian evangelism:

As the century draws to a close, mission leaders are increasingly talking about the subject of "closure". Here, then, is a working definition. Closure: The completion of the task of presenting the Gospel to every person in the world -- in his mother tongue, or an understandable trade language -- while providing an opportunity for those who respond to grow toward maturity in Christ through a local body of believers. [[more](#)]

The challenge of closure has been extensively explored by Hilary Lawson (*Closure: A Story of Everything*, 2001). It is an attempt to provide an account that overcomes the problems of self-reference inherent in other philosophical systems. In the words of one reviewer, Tim Gwinn (2004):

Both realism and relativism take as a basis that there is some 'thing' - namely, the world - to which these accounts are deemed to apply. By contrast, the beginning in *Closure* is to not take the world as a 'thing' to be grasped or understood. Instead, the world is to be thought of as the "openness", which is the site or space of possibilities that occur in the absence of our attempts at comprehension. Lawson uses the phrase "undifferentiated flux" as another way of attempting to illustrate the notion of "openness". (But this is illustrative and not meant to indicate some physical "flux".) In this sense, "openness" is not a 'thing', but a lack of our imposing of closures.

"In the context of the individual, openness can be conceived as the other of experience. Not as a collection of things that are the external cause of inner experience, but as the space within which experience takes place. In addition, openness can be conceived as the other of language. Once again, not as that to which language apparently refers, but as the space within which the activity of language takes place." [p. 3-4]

'Things' occur with closure. "Closure can be understood as the imposition of fixity on openness....It is the conversion of flux into identity, the conversion of possibility into the particular." [p. 4] [[more](#)]

The inadequacy of any explanatory closure is also the fundamental theme of Kurt Gödel's incompleteness theorem (1931) with regard to mathematical and philosophical questions -- proven by a particular use of prime number theory (see E Nagel and J R Newman. *Gödel's Proof*, 1958) [[more](#)]. This challenge has also been explored by Douglas R. Hofstadter (*Gödel, Escher, Bach: an Eternal Golden Braid*,

Self-reflexively, in relation to the more appropriate exploration of more insightful questions that is the theme of this paper, it may therefore be asked *what* kind of closure is sought by *who* -- *when*, *where* and *how* -- and *why*?!

Reframing possibilities of closure

Rather than seeking the stasis normally associated with closure, the emphasis here is on the nature of the dynamics associated with navigation in the knowledge space through continual interactive questioning of that context.

This might be understood as the cognitive analogue to the challenge of Arthur Young in developing the helicopter. This is likely to have been what led to his later exploration of process thinking. Young's [Theory of Process](#) is a formal analytical tool, a model based on number theory, geometry and topology -- as well as on traditional wisdom disciplines and other modes of knowledge and insight -- in an effort to help comprehend and integrate a number of disciplines and areas of inquiry. One articulation in physical terms of this challenge is the thesis summary of Shumin Zhai ([Human Performance in Six Degree of Freedom Input Control](#)):

This thesis is concerned with design factors that influence human performance in manipulating the location and orientation of three dimensional (3D) objects with six degrees of freedom (6 DOF). The need for this research has emerged from the development of a variety of advanced technologies. Technologies such as virtual and augmented reality (Barfield and Furness, 1995) telerobotics (Sheridan, 1992b), computer aided design (Majchrzak, Chang, Barfield, Eberts, and Salvendy, 1987), scientific data visualisation (Card, Robertson, and Mackinlay, 1991), and 3D computer graphics and animation (Foley, van Dam, Feiner, and Hughes, 1990) all require designing interfaces to let human users control 6 degrees of freedom of objects (robot, data, or viewpoint) in 3D space.

Given the many and varied approaches touching on the cognitive challenge, it would also be totally presumptuous to seek closure. In fact it is more interesting to see the many approaches as interweaving -- twisted together in various kinds of knot -- into a pattern whose outlines preclude closure, even when they can be intuitively recognized to some degree. Perhaps as some form of cognitive [Klein bottle](#)?

Some of the tantalizing approaches that enrich this understanding are presented in the following table. It would be good to think that the dimensions of such a table could point to a higher ordering of the preoccupations that it endeavours paradoxically to hold. Could they be usefully ordered in terms of WH-questions with respect to higher order reality?

Approaches: clues to ways of engaging with higher order reality		
Each maps into the other through complex transforms of which they are each respectively a metaphor		
Each is itself a knot and its own metaphor (symbol, configuration, question, etc)		
Themes	Authors	Exemplars
Questions		cognitive condition
Embodiment / Enaction	Francisco Varela	subject/object, embodiment of mind
Measure formulae	Arthur Young	analysis of dynamic kinetic
Virtues / Vices		art of driving, values as attractors
Numeric epistemology / Pattern	Xavier Sallantin	radical ordering induced by necessary fundamental cognitive assumptions
Genetic code / DNA		
Symbols of sets		archetypal roundtables, mandala, tribes
Metaphor		allusion, representative tokens, enneagram, mandala, Garden of Eden
Topology		helix, knots, twist, toroid
Self-reflexive	Douglas Hofstadter	
Cultural categories	Magoroh Maruyama, W T Jones, Howard Gardner	
Biological constraints on mind	Antonio de Nicolas	
Configuration	R Buckminster Fuller	spherical roundtable
Polarization		polar configuration
Transitions	Rene Thom	catastrophe theory
System levels	J G Bennett	levels of principles
Strategic dilemmas		
Dialogue styles		
Logic	Kinhide Mushakoji	quadrilemma
Levels of comprehension	Ron Atkin	
Changing classificatory frameworks	Patrick Heelan	
Patterns of change	<i>I Ching</i>	
Interaction		solenoid, tantra

The challenge of such ordering has also been explored elsewhere by the author (*Patterns of Conceptual Integration*, 1984).

Helicoidal coding

The processes by which any one such approach maps into another call for particular attention. For example, Xavier Sallantin has long taken a very fundamental approach to the natural foundations of digital data processing aimed at the exegesis of machine languages (*Le Métalangage naturel de l'informatique digitale*). This raises questions about the relationship to Young's approach. In Sallantin's application of the theory (*Genetics: the digital key to genetic coding*, 2001) he postulates and exploits an ontological connection between the elementary logical functions and the physical functionings.

In theory these functions are defined by conjugating three arithmetical idealities: the ideas of zero, unity and duality. The phenomenal expression of this conjugation is allowed by the fundamental variables Time, Force and Space, as well as being conjugated within any action. These first correlations among arithmetical signified and physical signifiers enable one to write the formula of three basic semantemes, or so called metasemes, the constituents of the meta-language of digital data processing. These three original metasemes are natural radicals of meaning, necessary and sufficient for the elaboration of all machine languages implemented by computers. The purpose of this paper is not to present the theory of univocal arithmetic but its application to genetics. Because of this, the study limits itself to the least one needs to know about these three original metasemes in order to give evidence that a fourth arithmetical ideality, the idea of three, is in fact implied by these three correlations.

In relating this approach to the fundamentals of genetics, he notes:

It is a well known fact that the genetic message is written with words of three letters, codons, taken from an alphabet of four letters, puric bases (in short U, C, A, G). The starting hypothesis retained is that this message is a coded message; in other words these four bases are the natural writing ciphers, namely the four representational figures of the numbers 0, 1, 2, 3 of the quaternary numeration system. In fact, if one writes these four figures by means of the four doublets of binary numeration: Zéro=00, One=01, Two=10, Three=11, then the codons become sextuplets consisting of the only two figures or digits, 0 and 1, used by the binary notation system. The 64 codons are therefore the first 64 integers, from 0 to 63.

In discussing the natural digitization of codons, Sallantin notes:

More precisely, unlike the animal, the sapiens is capable of performing mathematics and poetry because he can find a way inside the fractal piling of abstraction and symbolization levels. He has a compass allowing him to distinguish between the inductive ascent and the deductive descent... Whereas the left-hemisphere is specialized in the reductive descent towards increasing abstraction, the left-hemisphere is specialized in the creative ascent towards increasing symbolization ; in the same way as one is born left-handed or right-handed, some are more endowed for objective reasoning and others for subjective imagination. Other concomitant works of cerebral neurology demonstrate today this human privilege of an innate programming that allows only the human newborn child to learn the univocal numbering

But the fact that digitization is related to a reference system implies differentiating between the level of the referred object and the level of the referring subject. Fractal dyslexia does not allow this differentiation for lack of an agreement of neurons on a common standard. Only our faculty of reflection, escaping this dyslexia, enables us to avoid confusing the inside representation from the outside reality. This faculty of reflection enables us to grasp what has been lived from the outside so that it can be objectivized. In brief, we can step out of a reality in order to seize its form which mathematics will then translate by a formalism.

In other words, the identification number attributed on this plan by the biologist working in classic univocal arithmetic to every codon could not be the number used by Nature when it digitizes in the only ambiguous arithmetic it uses. To discover this natural numbering, it is necessary to release oneself from the human power of abstraction and to refrain from relating to a Cartesian reference system....

Sallantin uses the details of experience on a helical pathway through a cube of 64 numbered cells (extensively illustrated using a multistory parking lot) to trigger this shift in perspective:

The helix threads being in opposite directions, these circuits are enantiomorphic like our two hands. The Northern circuit goes through both upper floors of the parking lot in double helix ; the Southern circuit goes through both lower floors of the parking lot in double helix ; there is an inversion of the helix thread of the Southern circuit when it changes floor, the same observation applies to the Northern circuit.

Sallantin points to the possibility of a software simulation of this non-Cartesian helicoidal trajectory "to feign the behavior of living people suffering from fractal dyslexia and it will save effort here and relieve the individual from the anthropomorphism of univocal arithmetic... NRA is indeed on the one hand the corresponding interface between 64 codons, and on the other, 20 amino acids and two punctuation marks".

The emphasis by Sallantin on the need for a helicoidal perspective suggests the possibility of an ordered comprehension of the twistedness that is the theme of the main paper (*Engaging with Questions of Higher Order: cognitive vigilance required for higher degrees of twistedness*, 2004) and related annexes (*Twistedness in Psycho-social Systems: challenge to logic, morality, leadership and*

personal development, 2004; *DNA Supercoiling as a Pattern for Understanding Psycho-social Twistedness*, 2004). Given the ethical challenge of twistedness, it is therefore interesting that Sallantin, as a mathematical epistemologist, has a related paper on the challenge of evil (*Le problème du mal à la lumière de la cyberscience*).



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