

**ECOLOGY, ANTHROPOLOGY, AND  
KEYNES' "ANIMAL SPIRITS"**

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**Context**

The merit of this short "Thought Piece" originates in the grand sweep of Nico Aspinall's inaugural FinSTIC Seminar and the contrast it provided.<sup>1</sup> A sweep and contrast that have allowed me to put some of my own parallel (systems) thinking — about economics and actuarial practice — in better order. Section headings, I should note, are integral to what I write. They may be read as a grossly abridged synopsis.

**Celestial Universe, Evolution, and the Climax Community**

To go from the celestial universe to molecular biology and the code of life is really quite something. If, when such a grand sweep is driven by the second law of thermodynamics, in the interests of advancing economic thought and actuarial practice, it is yet something more. It is Systems Thinking. To loop over to the metaphors of ecological systems (as Nico did) is still more of what is, in fact, Systems Thinking of a *cross-disciplinary* nature.

The sense was this. Life is ever creating free energy. The second law of thermodynamics is thus driving an ecosystem, begun with pioneering types able to exploit abundant resources, ever inexorably towards the climax community. Which community is especially talented in creating systems of exquisitely intricate, inter-related structure, not least for storing the mobilised and captured resources. If this evolution were so, the behaviour of ecosystems — *and* economies (because they were the focal destination of Nico's seminar) — would be dominated in turn by two classes of biological species and agents: the swashbuckling, risk-taking, pioneering types; and the "complexifying", risk-managing, resource-conserving types.

So there can obviously be something significant about the *evolutionary* in economic thought and actuarial practice.

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<sup>1</sup> "Thermodynamics, Replication, and Ecology: What Do They Mean for Economics?", 23 September, 2020 ([https://finstic.org.uk/?page\\_id=213](https://finstic.org.uk/?page_id=213)).

## Animal Spirits and the Sociability of Beings

Along the way, however — in all of this evolution and biological life’s creative pursuit of thermodynamically free energy — some of those animal spirits of Keynes and the human propensities of Greenspan<sup>2</sup> have inveigled their way in, not least in respect of we humans as social beings.

How very inconvenient! How very disruptive. Like those all-too-familiar gales and avalanches of Schumpeterian creative destruction — if not Mazzucato’s “destructive creations”,<sup>3</sup> or Buffett’s *ur-alt* “economic discontinuities”<sup>4</sup> — which set seemingly inexorable progress back from time to time.

So when it comes to animal spirits and sociability, there also has to be something significant about the *institutional* in economic thought. Something about how we organise ourselves into different groups (of “swashbucklers” and “complexifiers”, for instance); into businesses, IFoA’s, FinSTIC’s, and the like; into different ways of problem-solving; profoundly differing ways of making decisions; and just as profoundly different ways of economising. Into ways, in sum, deeply entrenched and solidified as so-called Durkheimian social solidarities (no less).<sup>5</sup>

### Something Obviously “Evolutionary” — and Something Not-so-obviously “Institutional” — About This Systems Thinking

What follows begins with Ecology, passes through social Anthropology, Actuarial Practice, and on to Neuroscience, hence the origins of those animal spirits. I too (like Nico) am asking myself — or rather others, hopefully economists among them — just what might these things mean for Economics?

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<sup>2</sup> Greenspan, A (2013), *The Map and The Territory. Risk, Human Nature, and the Future of Forecasting*, Penguin, New York.

<sup>3</sup> Mazzucato, M (2013), “Financing Innovation: Creative Destruction vs. Destructive Creation”, *Industrial and Corporate Change*, [doi:10.1093/icc/dtt025], pp 1-17.

<sup>4</sup> As cited (from 1975) in Clacher, I (2019), “Economic Thought and Actuarial Practice”, *Research Report*, Institute and Faculty of Actuaries (IFoA), London, p 21.

<sup>5</sup> If one is not a trained social anthropologist, it is not at all easy to get to the bottom of what the “institutional” or the “institutionally embedded” amounts to. While this is discussed with the best illumination for me in a chapter by Thompson and Rayner on “Cultural Discourses” in the 1998 book *Human Choice and Climate Change* (1, The Societal Framework, pp 265-343), let me offer the following simple explanation. Imagine a *universe* of rules for problem-solving and decision-making. Affairs are (plurally) institutionalised when plural groups of people (solidarities) avail themselves of but their own distinctive, idiosyncratic *subset* of these rules in their own distinctive style of decision-making or risk-coping.

## **Appropriating Ecology; Pontificating on Economics**

But an acknowledgement is necessary. A certain intellectual humility is indispensable to enquiry in this inter- and multi-disciplinary realm. I note therefore these two things.

First, “ecology”, with its ecosystems, must be one of the most appropriated disciplines of our time. If I declare myself as an engineer, and a control engineer (worse still), I can sense horror welling up in some ecologists.

Second, if instead I were a trained economist, I would feel just a little irked by how many people from so very many other disciplines are for ever telling me what is the essence of “my” discipline.

And a third thing, for which I shall not apologise. I challenge anyone to say something of substance about Systems Thinking in less than 750 words, which is about what I have used up in coming just this far!

### **Health Warning**

To skim (as now I must) across the tops of Ecology, Anthropology, Actuarial Practice, Economics, Neuroscience, and Control Engineering — in the dozen or so pages to follow (including an Appendix) — is to court obvious criticism: of an excess of conceptual leaps in an argument spread molecularly thin over too many disciplines. My end-point images, of a hermit-like Adaptor strategy for decision-making and a mouse- or moose-like financial asset class, may evoke nothing but the haughty disbelieving scoff.<sup>6</sup>

Yet it is essential that I travel to such lengths at such considerable speed, to demonstrate adequately in one shortish document what I intend in the value of cross-disciplinary Systems Thinking.<sup>7</sup>

### **Thus: Read More!**

(As those heroically short blogposts invite the reader)

### **Holling’s Adaptive Eco-cycle and Seasons of Risk**

One of the truly greats of Systems Thinking, ecologist C S (Buzz) Holling (1930-2019), held that the complexifying climax community was not the culmination of evolutionary ecosystem

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<sup>6</sup> In their 1990 book *Uncertainty and Quality in Science for Policy* (Kluwer, Dordrecht), Silvio Funtowicz and Jerry Ravetz propose a matrix for judging the pedigree of research. It entails degrees of “peer-acceptance” for the work one is doing and degrees of “colleague consensus”. In these it does not escape my attention that it may be bad to be labelled a “rebel” by one’s colleagues, worse still a “crank”.

<sup>7</sup> By way of compensation, however, I offer indications of how each skimming touch of a discipline can be anchored in the basis of more substantial literature, mostly in footnotes such as this.

development. Rather, there was what he called an adaptive eco-cycle in a system's dynamic affairs, with four (not just two) phases, with overall system-wide behaviour being dominated by four (not just two) communities of biological types. He configured his eco-cycle as a figure of 8 on its side, a " $\infty$ ": with a forward loop of two phases, for predominantly swashbucklers and complexifiers; and a back loop also of two phases, one for what he called creative destruction (borrowing from Schumpeter), i.e., the breaking down and liberation anew of the once bound-up resources, the other rebirth and regeneration, within and from the freed resources.

Evolution over the aeons would take place continually: according to the everyday high-frequency disturbances in micro time; the changing seasons of risk over the longer-term of macro time, as too Holling's phases of his eco-cycle; and insurance-economic cycle ( $\infty$ ) after insurance-economic ( $\infty$ ) cycle, on and on — as time (aptly enough) tends to infinity, or symbolically " $\rightarrow\infty$ ".

### **Organising, Disorganising, and Cross-disciplinary Systems Thinking**

What Holling says of his adaptive eco-cycle, says likewise cultural anthropologist Michael Thompson of possible successions of decision-determining social solidarities in an institution, not least an insurer. And he does this with a masterful flourish of cross-disciplinary Systems Thinking.<sup>8</sup> This is how Thompson puts it: "Man and Nature as a Single but Complex System". It appears, significantly, as a chapter in his 2008 book *Organising & Disorganising. A Dynamic and Non-Linear Theory of Institutional Emergence and Its Implications* (Axminster, Triarchy Press).

There is, then, systems ecology and systems anthropology. All we need now is some systems economic thought — actually, some Institutional Evolutionary Economics (IEE) is preferred (and duly built on the pillars of the "evolutionary" and the "institutional") — along with some systems actuarial practice.<sup>9</sup>

### **Actuarial Practice, Cultural Theory, Plural Rationality and Rational Adaptation**

Enter actuarial professional Dave Ingram, stage west, as it were. He was working (in the 2000s) for ratings agency Standard and Poors in New York. Experience had shown Ingram, again and again, that there were three (if not four) ways of coping with risk and decision-making in the insurance industry, not the conventional two rationales. Insurers were found to employ not only some swashbucklers and complexifiers, but also some risk-averse types

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<sup>8</sup> A systems sketch of the idealised essence of this can be drawn. Together with its idealised procedural explanation, this sketch can be found in the Appendix.

<sup>9</sup> Institutional Evolutionary Economics is the subject of a recently completed (2020) project for the (US) Society of Actuaries (SoA) and a future book.

mesmerised by all manner of feared and imagined Schumpeterian gales, if not yet others with an instinct for “risk-absorbing” — for battening down the hatches and riding out the economic storms (until rebirth, bounce back, even bounce forward, can re-assert themselves).<sup>10</sup>

In Ingram’s search for a sufficient explanatory theory, he happened upon a 1990 book *Cultural Theory*. It is co-authored by Thompson.<sup>11</sup> Its essence (for present purposes) is effectively re-crafted, re-expressed, and extended in *Organising & Disorganising*: four ways of organising (“institutionally”, that is); four ways of trying to disorganise the other three competitor ways of organising; four rationalities, i.e., four ways of coping with risk and making decisions, one for each season of risk; four distinctively different subsets of rules within the universe of problem-solving rules.

The partnering of Ingram and Thompson was another impressive instance of cross-disciplinary Systems Thinking at work, this time in articulating the matter of risk-coping from Actuarial Practice to Anthropology, and vice versa. It culminated in the expression of Rational Adaptability in ERM<sup>12</sup>: for coping with risk in the face of the inevitable surprises, when one season of risk shifts qualitatively to another. From Moderate, to Bust, to Uncertain, to Boom, to whatever, as Ingram and Thompson would say. Just as one phase in Holling’s adaptive eco-cycle might shift to another: from complexification, to (creative) destruction, to rebirth and renewal (under battened down hatches), to swashbuckling, to whatever.

That, then, is the *institutional* in economic thought and actuarial practice.

### **Economy, Technology, and Society’s Needs-Wants: All Co-evolving Systems ... But ...**

If there is learning and adaptation as the seasons progress and turn, so there is the scope for the *evolutionary* in economic thought and actuarial practice over the (much) longer term.

W Brian Arthur published a book in 2009, *The Nature of Technology. What It Is and How It Evolves* (Simon & Schuster, New York). He writes as an engineer who has become an (evolutionary) economist. And though his subject is primarily technology — how it is invented, how it becomes part of innovation, thus to serve a human-social need or want, how

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<sup>10</sup> An instructive (non-ecological) definition and context for resilience as bounce forward is given in an exemplary piece of cross-disciplinary Systems Thinking in respect of regional economies: Martin, R, and Sunley, P (2015), “On the Notion of Regional Economic Resilience: Conceptualization and Explanation”, *J Economic Geography*, **15**(1), pp 1-42. I have myself worked at (and toyed with) this wonderfully complex and elusive notion of “resilience” in a system’s structure and behaviour, and very much (as here) from a cross-disciplinary stance: see Beck (2018) “Bring on the Floods”, *The Source*, May (<https://www.thesourcemagazine.org/bring-on-the-floods-how-water-professionals-can-help-make-cities-resilient/>).

<sup>11</sup> Thompson, M, Ellis, R, and Wildavsky, A (1990), “*Cultural Theory*”, West View, Boulder, Colorado.

<sup>12</sup> *InsuranceERM* (2009-13), A Compendium of six articles authored by Dave Ingram, Michael Thompson, and Alice Underwood

therefore it surfaces in the economy, therein to be described as “structural change” — his real target is economics, in particular, economics with an evolutionary turn of mind. Technology creates itself, he argues. It is, in systems phrasing, autopoietic. As technology evolves, so the economy co-evolves with it, as too human needs and wants co-evolve with the economy and technology, which induces in turn co-evolution once more in technology, and so on, and on, and on ... *ad infinitum*.

Arthur’s definition of technology is very broad. Tellingly so. It embraces not just nuts, bolts, widgets, steam engines, and the like, but stock markets, banks, the law, government regulatory regimes, and — for us here and now — the insurance sector *and* the ways we support and make decisions in actuarial practice (not least with models).

**... But ... There’s a Problem:  
Plenty of Co-evolution —  
None of Those Institutionalised Animal Spirits**

There are no institutionalised Keynesian animal spirits in any of the co-evolution. There are no institutionalised, Greenspanian human propensities in the wonderful image of the flashing networked bulletin board Arthur conjures up for the beating heart of his threesome of co-evolving systems ( $\{\text{technology}\}$ ;  $\{\text{economy}\}$ ;  $\{\text{wants}\}$ ). Nor are there any of the same in the flashing network of autocatalytic chemical reactions, in which biological life on earth is supposed to have originated. For that is how Arthur’s erstwhile Santa Fe Institute colleague, Stuart Kauffman, visualises and reasons about life’s origins in his 1995 book *At Home in the Universe* (Oxford University Press, Oxford) — echoes of which I could sense reverberating around Nico Aspinall’s seminar.

**Infusing the Necessary Spirits into the Narrative**

It is quite possible to imagine the following quasi-algebraic narrative for the way in which the three systems ( $\{\text{technology}\}$ ;  $\{\text{economy}\}$ ;  $\{\text{wants}\}$ ) co-evolve:

**{Technology (varying over times  $t$  and  $T$ ) as the Means to Mobilise Resources}**  
co-evolves with  
**{Economy and Ways of Economising, including Actuarial Decision-Making  
(varying over times  $t$  and  $T$ )}**  
in meeting the every-bit-as-much co-evolving  
**{Human-Social-Business Needs & Wants (varying over time  $T$ )}**  
all enfolded within longer spans of business-cycle after business-cycle  
as the cycles evolve over times  $T$  and  $\infty$ .

In this, as a control engineer, I have allowed myself to write the shorter-term micro time of day-to-day decision-making as  $t$ , the longer-term macro time of the seasons of risk as  $T$ , and the yet longer term of business-cycle after business-cycle as  $\infty$ . This spectrum of time-spans  $[t;T;\infty]$  is no excess of notation, as we shall see shortly.

Not explicit in this narrative (because things would become even more complicated than they already are) is the way in which the plural rationalities of Cultural Theory are institutionally embedded in each of the three systems, and Keynes' animal spirits along with them: as plural ways of inventing and innovating technology; as plural ways of economising; and as plural ways of inventing and relinquishing wants. Significantly, the engine of these three "plural ways" is the likewise ever co-evolving system of {power-persuasion}: among those agents "determining" the {technology}; those "determining" the {economy}; and those "determining" the {wants}. It is the {power-persuasion} structure of how the four (soon to be *five*) solidarities-*cum*-rationalities seek to organise and disorganise each other over time, hence the waxing and waning in the numbers of their respective adherents and proponents. The dynamics of this (fourth) system can be found being addressed in the closing chapter of Thompson's 2008 book.

Staggeringly complex? Yes. But what else should be expected.

### **Time and Co-evolution: The Long and the Short of It All**

There is more to evolution and co-evolution than along those paths defined as, first, one species in and of itself (one decision agent) and, second, one species *vis à vis* another species in the system (of plural solidarities and types of risk-copers among the decision-influencers in an insurer).

There is a third avenue, within the workings of the spectrum of  $[t;T;\infty]$ : co-evolution of species, hence the system as a whole, with the every-bit-as-much co-evolving spectrum of variations in time ( $[t;T;\infty]$ ) of the patterns of disturbances to which species (as parts) and the system (as a whole) are subject.

In sum, the short-term ( $t$ ) and the long-term ( $T$ ) of it all ( $\infty$ ).

A system subject to short sharp shocks, for instance, will co-evolve to have species who prosper in such a shocking discontinuous, punctuated environment. An economy subject predominantly to slow, rumbling, low-amplitude but persistent up and down forces will eventually have businesses that prosper in such an environment. Perhaps, significantly, they will be those populated by just the two styles of risk coping, of the swashbucklers and complexifiers. *Absent* the stimulating shocks, creative destructions, and storm-induced battenning-down-of-hatches, the other two styles of risk-coping may well go extinct (or never originate in the first place).

### **And So to the Fifth Rationality of the "Special +1" — the Adaptor Type**

There are not just the four styles of risk-coping of Rational Adaptability in ERM, or the four classes of systemic stability-instability for the four phases of Holling's eco-cycle. There is a

fifth way of seeing the world and acting in it, one we label as that of the Adaptor.<sup>13</sup> One who is utterly absorbed in supporting and enhancing a company's social and material resilience over the *longer* term (of  $T$  and  $\infty$ ) — as opposed to the other four rationales, for coping with company stability-instability in the *short* term of  $t$ .<sup>14</sup>

So much, then, for that blend of Systems Thinking *à la* Ecology, Social Anthropology, Actuarial Practice, and Economics. Yet though the matter of infusing Keynes' animal spirits into Arthur's view of an economy has been written of above, the injection thereof — *via* the Cultural Theory of Anthropology — has not in fact been fully followed through. Some Neuroscience is needed, upon which very discipline we now alight.

### **Keynes' Animal Spirits, Thermodynamics, and the Twist in this Systems Thinking Tale**

Nico's seminar swept impressively from the celestial universe to molecular biology and on to the code of life. And *there*, right there, is to be found a little twist in the tail of this thermodynamically inspired logic.

The code of life is manifest in the nervous system and brain functions of the human body. In Neuroscience there is something called the "somatic marker hypothesis" (it has been around for a quarter of a century or so). This hypothesis posits that subliminal emotions, feelings, and drives — born within us of an earlier evolutionary era — facilitate and expand the later-arriving "rationality": that of the "rational choice analysis" that has come completely to dominate contemporary economic thought.<sup>15</sup>

Keynes' animal spirits do indeed inveigle their *biological and physiological* way right in (if you buy into the somatic marker hypothesis, that is). What is more, insights from Neuroscience indicate that they do so in a plurally rational way that corresponds to the plural styles of risk-coping Dave Ingram had distilled from years of actuarial practice and the plural ways of economising deduced likewise a decade ago from Michael Thompson's Cultural Theory.<sup>16</sup>

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<sup>13</sup> A first blueprint of the Adaptor has been drawn up in the earlier referenced contemporary (2020) SoA project, on "Modelling the Variety of Actuarial Decision Making".

<sup>14</sup> Having looked into this in greater depth, I came to the view that there is not that much difference between Holling's notion of resilience and his principle of adaptive management and Taleb's notion of "antifragility" and the principles that *might* guide his "antifragilising agency", although such agency deserves a second look. My first look, in a contemporary review of Taleb's 2012 book *Antifragile, Things That Gain from Disorder* (Random House, New York), had no (2020) blueprint for the Adaptor rationality and its agency to hand: see Beck (2013), "Antifragility, Resilience, Sustainability & the City — Bring on the Floods!" (<http://cfgnet.org/archives/1329>).

<sup>15</sup> Verweij, M, and Damasio, A (2019), "The Somatic Marker Hypothesis and Political Life", in *Oxford Research Encyclopedia of Politics*, Oxford University Press, Oxford [DOI: 10.1093/acrefore/9780190228637.013.928].

<sup>16</sup> Thompson, M (2010), "A Bit of the Other: Why Scarcity Isn't All It's Cracked Up to Be", in *The Limits to Scarcity. Contesting the Politics of Allocation*, (L Mehta, ed), Earthscan, London, pp 127-142.



## **Practice — Don't Just Ponder There; Do Something With All This Systems Thinking!**

There is a spin-off company in Vienna whose business is built on network (systems) science.<sup>17</sup> It has been engaged in building and enhancing resilience in the affairs and performance of an innovation ecosystem on the site of the former Tabakfabrik in Linz, Austria. The Systems Thinking behind this intensely practical matter, with eventual effect, runs as follows.

In a social world, Holling's adaptive eco-cycle ( $\infty$ ) can be argued to be punctuated by four "social traps" at the transitions between each of its phases, between each of the seasons of risk in ERM.<sup>18</sup> Multiple personality types — labelled summarily and variously as "the fighter", "the ruler", "the destroyer", and "the healer", for instance — each have their own distinctive roles to play at various points around the innovation eco-cycle (or, for that matter, around the seasons of risk of the insurance-business cycle). Others (among 12 in total), "the sage" and "the prophet", for example, may facilitate escapes from the traps and, more seriously, from entire system lock-ins.<sup>19</sup>

The practical challenge to be met is this. Is the "inventory" of employment niches in all the constituent businesses of the entire ecosystem replete with the requisite spectrum of personality types for serving the goal of resilience? If not — because some of the niches are no longer occupied by the requisite personality type (they have gone extinct) — then someone (in a notional human resources department for the *entire* ecosystem) needs to act: to recruit prospective employees with the right personality traits to fill the empty slots.<sup>20</sup>

If that was actual adaptor practice for what we may refer to as the "social" world of a business or business ecosystem, what of acting with resilience in the service of a business's companion "material" world?

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<sup>17</sup> FASresearch: <https://www.fas-research.com/about-us>.

<sup>18</sup> These four social traps are precisely coincident with four of the twelve entries in the surprise typology of Ingram's, Thompson's, and Underwood's Rational Adaptability in ERM, the subject of their compendium of six articles in *InsuranceERM* (2009-13). Elaboration of the social traps can be found in Fath, B D, Dean, C A, and Katzmaier, H (2015), "Navigating the Adaptive Cycle: An Approach to Managing the Resilience of Social Systems", *Ecology and Society*, **20**(2), 24 (<http://dx.doi.org/10.5751/ES-07467-200224>).

<sup>19</sup> The labels of the personality types may appear as trivialized caricatures. But what lies below them in — *inter alia* — Psychology, Art, Politics, Religion, Literature, and classical Greek Mythology runs deep enough.

<sup>20</sup> That "someone", as argued in the (2020) SoA project report, should be the archetypal Adaptor type of the fifth rationality. In practice, in the Tabaktrafik ecosystem, the founder of FASresearch, Harald Katzmaier, approximates such a type (something he wisely neither confirms nor denies!).

**Scoff Not!!**  
**Find (and Re-engineer) the Mouse and the Moose**  
**of Asset Classes for Your Investment Portfolio!**

Sustaining the duplicated diversity of personality types associated with Linz’s Tabakfabrik innovation ecosystem is an answer originating in systems ecology to a question we might ask of systems anthropology (which we do, in the Appendix). If we asked the identical question of systems economics — What should be the design and operation of a resilient investment portfolio? — the answer, now from both systems anthropology and systems ecology, is but half-baked, if not quarter-baked (but better than nothing, as we observe in the Appendix).

It lies, I think, in what ecologists would call the “soft redundancy” in the existence-critical functions of the (whole) ecosystem: that they be discharged by duplicate constituent species, which replicate each other’s roles, possibly at quite different scales.<sup>21</sup> Famously, and with (deliberate) alliteration, resilience in the behaviour of a wetland ecosystem — resilience, that is, of the ecological (bounce-forward) variety as opposed to the engineering (bounce-back) variety — resides in the way the moose and the mouse replicate at least two of the viability-critical functions in the entire wetland ecosystem.

This — re-surfacing (in the Appendix) as a quarter-baked answer to the motivating original economics question — might read as follows. The desired “soft redundancy” resides in the portfolio’s mission-critical functions being serviced by duplicate constituent assets, which replicate each other’s distinctive roles, possibly at quite different geographic, economic, *and* temporal scales — certainly at the fast ( $t$ ) and the seasonal ( $T$ ), if not the business-cyclical ( $\infty$ ), and without any procyclicality.<sup>22</sup>

Which is where the discipline of Control Engineering might start mixing it with the other disciplines in this narrative of Systems Thinking. Above all a control system is designed to re-engineer the dynamic behaviour of a system, and so that it is more to “our liking”,<sup>23</sup> most

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<sup>21</sup> Peterson, G, Allen, C R, and Holling, C S (1998), “Ecological Resilience, Biodiversity, and Scale”, *Ecosystems*, **1**, pp 6-18.

<sup>22</sup> The differing speeds of metabolism and movement of the mouse and the moose, and their dramatically different inertia, are reflected in the abstract systems-level properties of their essential underlying dynamics, including in response to all manner and patterns of disturbances impinging upon them from their respective environments. Below the disciplinary surface, at the systems level, these dynamic properties of the services the mouse and moose render to the ecosystem might be likened to the ups and downs, the under- and over-shoots, the bounciness, the under- or over-damping (and so on) in the behaviour of the mass in the archetypal spring-mass-damper mechanical system, when subject to perturbation. Appeal to precisely this metaphor has been made in studies of the slowly changing successive responses of economic systems to one form of Bust after another, from the way these evolving responses are reflected in time-series of GDP data. Original references for this line of enquiry are as follows: (1) Diks, C, Hommes, C, and Wang, J (2015), “Critical Slowing Down as Early Warning Signals for Financial Crises?”, *Working Paper*, Department of Quantitative Economics, University of Amsterdam, The Netherlands; (2) Rye, C D, and Jackson, T (2016), “On the Use of Instability Indicators in Exploring Inter-decadal GDP Variability”, *Working Paper 4*, Centre for the Understanding of Sustainable Prosperity (CUSP), University of Surrey, UK. The more precise context of this metaphor is elaborated a little further in the Appendix.

<sup>23</sup> Of which, unsurprisingly, there may be a plurality, because — as we should challenge ourselves — to which of the four (five) social solidarities does the “our” belong?

obviously in respect of its stability in the shorter term. Could it do something for the ecological resilience of an investment portfolio in the longer term? What would constitute an asset with the dynamics of a mouse, for example, relative to those of some moose of another asset?

## Appendix

### CROSS-DISCIPLINARY SYSTEMS THINKING: WHAT IT MIGHT COME UP WITH

The *procedure* — ah, if only such things could be so readily squared away as they are in Figure 1, with its rectilinear blocks, clear spaces between them, and straight arrows! Quite inadequate though this is, Figure 1 is nevertheless my best current visualisation of the gist of cross-disciplinary Systems Thinking. It is inevitably idealised and massively simplified. So too will be the following step-by-step procedure for illustrating how any Thompsonian flourish around Figure 1 should work.

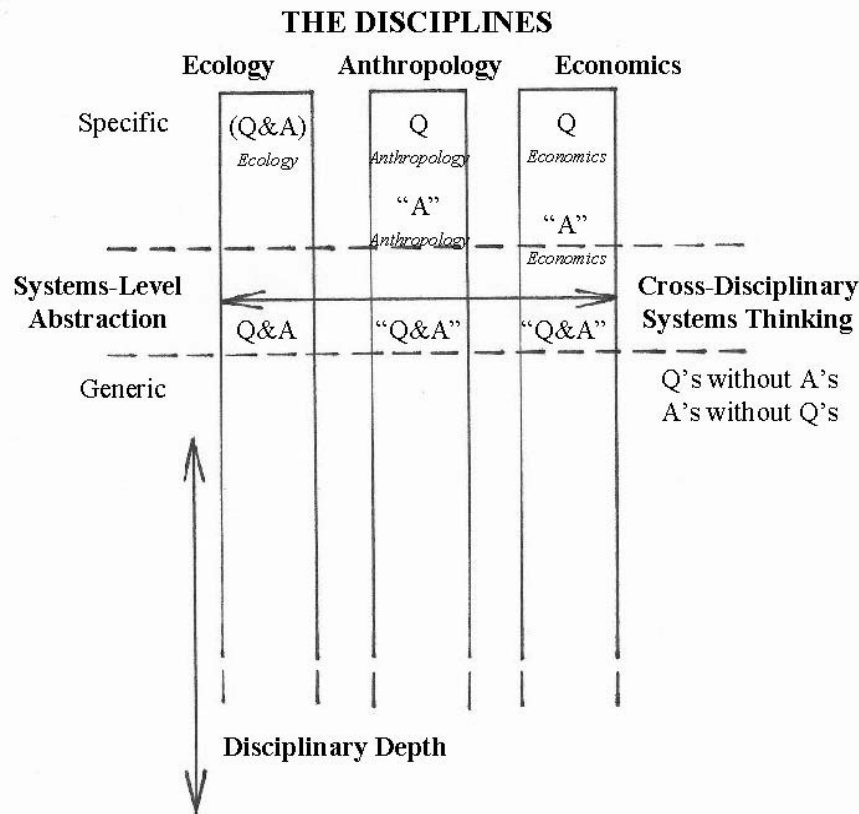


Figure 1. Arrangement of disciplines and a visualisation on which to construct a "procedure" for cross-disciplinary Systems Thinking.

#### *Specific Disciplines in Depth — Generic Systems-level Breadth in the Abstract*

There are three *specific* illustrative disciplinary columns in Figure 1, for Ecology, Anthropology, and Economics, each with their own conventional disciplinary knowledge in depth, and ever deepening.

There is the one cross-disciplinary bridge, or cross-disciplinary communications busbar,

where, at some systems level, we imagine the presence of a host of abstracted “Problem-Solution” couples, “Questions and Answers”, Q’s & A’s in short — (Q&A)’s even more succinctly. Three such abstracted, hence *generic* (Q&A) couples are placed in Figure 1 at the intersection of each disciplinary column with the cross-disciplinary bridge.

Another (Q&A) couple is located at the top of the Ecology column. It bears the specificity and disciplinary notational clothing of  $(Q\&A)_{Ecology}$ . Its parts are accordingly a  $Q_{Ecology}$  in Ecology and its companion  $A_{Ecology}$ .

Only questions appear at the tops of the Anthropology and Economics columns,  $Q_{Anthropology}$  and  $Q_{Economics}$  respectively. Their respective tentative answers, perhaps very tentative, “A”<sub>Anthropology</sub> and “A”<sub>Economics</sub> are caught rising partway back up from their respective counterpart cross-disciplinary, abstracted “(Q&A)”s below.

**“Reasoning”:  
Down, Across, Forth, Back, Up and Around (and Around).**

I hesitate to draw any dotted links in Figure 1. They would imply far too tight and disciplined a form of reasoning. The only such directions that might broadly hold are down, across, forth, back, and up (and around), and again and again.

**Problems & Solutions; Questions & Answers; Q&A**

Let us start in the upper reaches of the three disciplinary problems and solutions, Q’s and A’s (duly qualified with discipline-specific subscripts). Suppose we are labouring away in Anthropology or Economics, on something having to do with organisation, or resilience, or adaptation. And suppose further (as I have so frequently) we have the whiff of something within our grasp of Ecology (modest though that grasp is), wherein a similarly shaped Q exists — *and* with an A (even two or more such candidate solutions). We have spotted, let us say, a promising  $(Q\&A)_{Ecology}$ , whose constituent  $Q_{Ecology}$  is redolent of our unanswered  $Q_{Anthropology}$ .

Harrying the  $(Q\&A)_{Ecology}$  down to the abstract, generic systems level, this  $(Q\&A)_{Ecology}$  couple may be stripped of its discipline-specific trappings to lay bare an unadorned, discipline-free (Q&A).

Sliding sideways across to the column of Anthropology, with an abstract (Q&A) from Ecology in hand (itself perhaps evolving along the way), the now obvious task confronts us: to craft and re-cloth a tentative “A”<sub>Anthropology</sub>, to look the same as the abstracted A in this (Q&A). And this entails dressing up the bare, abstract, generic A in the disciplinary substance of Anthropology, as this at first quarter-baked, and then half-baked “A”<sub>Anthropology</sub> is projected back up its column towards the unanswered  $Q_{Anthropology}$ , with which we began.

In Figure 1, if we could similarly spot and sculpt the unanswered question actuarial practice would have for economic thought and Economics, a gripping  $Q_{Economics}$  indeed (not least in the

light of the 2019 IFoA Clacher Report on “Economic Thought and Actuarial Practice”), so the various discipline-specific and abstracted (Q&A)’s of both Ecology and Anthropology (not to mention the off-stage Control Engineering) could be mobilised in the service of arriving at the corresponding “A”<sup>Economics</sup>. For its part, this might be just a quarter-baked solution — but better than nothing.

### Some Disciplinary Clothing and Specificity

To make what has just been written tangible, consider the following threesome of discipline-specific, but isomorphic questions (Q’s):

*Ecology.* What constitutes resilience in the organisation of an ecosystem?

*Anthropology.* What constitutes resilience in the organisation and dynamics of the “social” world of decision-influencers in an insurer?

*Economics.* What constitutes resilience in the design and performance of the investment portfolio in the “material” world of an insurer?

Ecology has four or five good answers (A’s) to its respective question (Q), as does Anthropology to its Q (in large, but not quite large enough, measure), as indeed does Economics, albeit, we conjecture, in insufficient measure.<sup>24</sup>

### Wooly Thinking, Poetic Expression ... No Apologies Whatsoever ... None!

As far as I am aware, Holling was the first to set out a formally shaped framework for cross-disciplinary Systems Thinking (in a contribution to the 1986 book *Sustainable Development of the Biosphere*).<sup>25</sup> The Thompsonian flourish with it, jointly with Holling, actually took place in a matter of just a few minutes during a coffee break from an afternoon seminar at the International Institute for Applied Systems Analysis (IIASA) in 1981 or thereabouts. The isomorphism between Ecology and Anthropology, encapsulated in the figurative symbol  $\infty$  (and drawn on the flip chart that day) was doubtless close to that eventually appearing as Figure 6.1 in Thompson’s 2008 *Organising & Disorganising* (p 100).<sup>26</sup>

If such cross-disciplinary Systems Thinking as I have now related seems little other than the

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<sup>24</sup> Development of the answers in Anthropology and, more so, Economics is the subject of the aforementioned contemporary (2020) SoA project. The previously cited paper by Peterson *et al* (1998) also refers.

<sup>25</sup> Holling, C S (1986), “The Resilience of Terrestrial Ecosystems: Local Surprise and Global Change”, in *Sustainable Development of the Biosphere*, (W C Clark and R E Munn, eds), Cambridge University Press, Cambridge, pp 292-317.

<sup>26</sup> And as Figure 3 in an earlier version of “Man and Nature as a Single but Complex System”, which can be found here: <http://cfgnet.org/wp-content/uploads/downloads/2011/11/Thompson>.

pejorative “wooly” kind of thinking, so be it. I make no apology.

If it suggests the positive merits of solutions (A’s) in search of a problem (Q), which search is *not* merely academic, but prompts the posing of a very good question not previously asked (as Figure 1 notes), again I make no apology.

If my expression of the procedure of such Systems Thinking seems almost poetic, unscientific, and without logic, still I make no apology.

Something we refer to as serendipity — perhaps out of exasperation at all attempts to pin things down with but the force of logic — may be at work. Or, more prosaically, this Systems Thinking may be little more than the glorified use of metaphor.<sup>27</sup>

In Brian Arthur’s 2009 book *Technology*, in which he seeks to do for Engineering what Kuhn did for Science, and Darwin for the origin of the species — and in which Arthur quite succeeds (and admirably so) — his attempt to chase down the very essence of “invention” strikes me as verging on the poetic. He says of it:

This continuous thinking [he happens to be referring to that of Isaac Newton] allows the subconscious to work, possibly to recall an effect or concept from past experience, and it provides a subconscious alertness so that when a candidate principle or different way to define the problem suggests itself the whisper at the door is heard.

Would this be something yet more of an animal spirit, something originating in an earlier evolutionary era, to complement, delight, and fuel — but *not* frustrate — the Johnny-come-lately “purely rational”?

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<sup>27</sup> The half- and quarter-baked ecological and anthropological answers to the economic question of designing and operating a resilient investment portfolio could very well benefit from pushing yet further the mechanical-system metaphor of springs, masses, and dampers. For, as noted earlier, it has already been employed in thinking through analyses of the purported ever-weakening restorative forces in national economies (Diks *et al*, 2015; Rye and Jackson, 2016). In a slightly different economic setting, some authors have appealed to the instability of London’s Millennium Bridge across the River Thames when first opened as an explanatory (mechanical) metaphor for the occurrence of systemic risk in financial systems (Danielsson, J, and Shin, H S (2013) “Endogenous Risk”, in *Modern Risk Management — A History*, Risk Books, <http://www.RiskResearch.org>). The metaphor is most interesting. Because what happened was an example of positive feedback between a {mechanical system} (bridge) and a {human-social system} (people walking across the bridge). Indeed, had there been a somehow “knowing” plurality of rationalities among the people on the bridge, the joint system might somehow have been stabilised, in real (operating) time. I wonder, therefore, to what that might point (if anything) in addressing and answering the economics question of how to design a resilient financial portfolio.