Review Chapter from forthcoming, 2017, book:

New Horizons for Second-Order Cybernetics

Edited by Alexander Riegler and Karl Muller

Some Implications of Second-Order Cybernetics

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From emergence to methodology

1. The overview that Karl Müller and Alexander Riegler draw of the actual and future possible field of SOC makes it easier to see the distinctions between first-order and second-order. Without those distinctions it is unlikely that second-order cybernetics (or science) will be able break out of the challenge of irrelevance asserted in the Kline-Martin Hypothesis. It seems to me that the time is ripe for a major thrust to take SOC into further domains not only for its deeper theoretical understanding but also because of its potential relevance to social transformation.

2. The history, momentum and successes of first-order science, coupled with enormous global investment in its institutions, communities and funding makes it no easy task to get the voice of second-order thinking heard. When this is coupled with the conclusions, which the review here confirms, that SOC has been little developed over the last fifty years and that there is very little evidence in the form of sustainable consequences for other domains of science, then the difficulty is exacerbated.

3. The emphasis Müller and Riegler place on research and development agendas for the future of SOC is a timely affirmation that the potential of SOC has hardly been tapped and developed. For example, the potential of the great insights of Heinz von Foerster, Gregory Bateson and Ernst von Glasersfeld coupled with the championing by Ranulph Glanville and Bernard Scott stands out as a rich field for exploration. I will introduce an additional way of framing the essential features of SOC, which I propose should also be extended to second-order science to broaden out the relevance. This framework emerged from the interdisciplinary workshop "Second-order Science and Policy" (SOSP, http://www.decisionintegrity.co.uk/page44.html) held early in 2016 to explore the potential relevance of second-order science to policy formation. I will then use this framework as a way of noting salient points from the various contributory chapters in an attempt to indicate the inclusive relevance of the rich diversity of perspectives represented.

4. Michael Lissack makes the case (§1) that the label "cybernetics" has, in use, lost contact with its essential meaning and needs new forms of expression. I see the switch to the term "second-order science" as one way of contributing to this task, but only if the concept is enlarged and made more comprehensive.

5. It seems fairly typical of paradigm clash that the incumbent marginalises the new that questions its assumptions. This leads to a kind of subterranean collusion to not even acknowledge there is a challenge. This leads further to the issue being hidden in plain sight:

> It seems that we have a blind spot for the fact that experience is the most basic and unavoidable medium of our being. Not only do we normally not notice how all our beliefs about ourselves and the world constitute experience; we do not notice that we do not notice. (Kordes §5)

6. The development of a flourishing community of second-order researchers is likely to be the most powerful way to open this up in discourse on the nature of science. Thomas Flanagan (§3) points out that the very nature of the interactions in a community of researchers changes expectations of what is considered to be a scientific finding. He summarised that a finding is a complex function of:

> (a) the observational and communication dynamics within the system under study
> (b) the conjoint sense-making methodology selected for use by the researcher and fellow actors
> (c) the focus on boundary conditions of the inquiry specified by the researcher
> (d) the adequacy of the reporting narrative.

7. The construction of second-order methodology could fall into an inconsistency trap unless it is recognised that a community of scientists have made choices as to what second-order methodology is. Approaching second-order methodology with first-order assumptions is unlikely to go very far. First-order methodology is limited by being based on linear causality (Martin §11), which is inconsistent with the importance of circularity.

8. This trap is avoided if the approach to methodology is itself second-order. The positive angle on this perspective is the scope for the conscious design of methodology. Lissack (§16) summarises seven insights that cybernetics has given rise to that need to be taken into account:

- the role of the observer
- the law of requisite variety
- the importance of the observer in cognition
- the use of black boxes
- the idea that all action is in some ways a conversation
- the importance of recognising that true models differ from descriptive representations
- the importance of narratives

9. Another useful view of methodology is provided by John Warfield's domain of science model (Flanagan §16) in which there is a continuing cycle between foundation, theory, methodology and application, which is portrayed basically as a learning cycle.

10. Müller (2016) outlines a seven-stage methodology that incorporates the principles of second-order investigation searching for systemic universality. In parallel to this I developed a similar approach in my doctoral research (Hodgson 2016).

Second-order science as designed practice

> We need an inclusive big tent rather than a divisive faction fight. (Cariani §14)

11. An excursion was made by SOSP(see §3), an interdisciplinary workshop to enlarge the concept of second-order science building on the core work of second-order cybernetics by "sweeping in," to use Charles West Churchman's (1979) expression, a broader range of approaches to science than is usually discussed in second-order cybernetics. All of these shared the initial starting point of the presence of the observer as critical in some way or another. The perspective that emerged from interdisciplinary dialogue across diverse fields of science, policy and practice provided a richer picture as to what the hallmarks of a second-order science practice might be. The enquiry was also facilitated to identify possible links between this emergent pattern and the challenges facing contemporary policy development – what the possible relevance and use of a second-order discipline might be. I will use this distillation of principles as a platform to explore second-order science methodology.

12. A key "so what?" question is "so how do we go about science differently if we intentionally adopt a second-order approach?" This can be treated as a design task affecting how we might carry out both theoretical and empirical investigation. Grandon Gill (§16) affirms:

> To be effective in highly complex environments, research designs need to be highly localised and need to shed some of the formalisms of the traditional scientific method, such as the hypothesis test (intended to support or refute stable, general propositions). In place of these approaches, the researcher needs to become highly aware of the interactions affecting the local context and must also become expert in the art of observation and the construction of models that reflected the local reality.

13. The concept used from here on in this review can be regarded as a meta-model to prompt the attention and awareness of the second-order practitioner. It is basically cast in what Müller and Riegler define as the endo mode, science from within.

14. The concept comprises seven distinct areas. However, they are also systemically connected and overlapping so, rather than a check-list they are better represented as a non-linear visual pattern as in Figure 1.

1. The triadic network: Observer, language, society

> Triadic networks in science can be built between (1) actors or researchers, (2) an environment or domain of investigation and (3) a common language, grammar, rule system or, more generally, a knowledge base. (Müller & Riegler §21)

15. The co-presence of observer, language and society (of scientists) is placed as central and strengthens the principle that the observer role is critical. The triadic relation is essential to von Foerster's (2003) viewpoint. He characteristically summarised this as analogous to the relationship between the chicken, the egg and the rooster. "You cannot say who was first and who was last. You need all three to have all three." The presence of the observer in the observation is proposed as a fundamental condition in second-order science. In this sense, all scientific knowledge is some form of intersubjective consensus

Figure 1. Seven domains constituting second-order science.

amongst a community of scientists. Where those scientists are ignorant of their assumptions about knowing, they are restricted by second-order blindness to the implications of their position. However, the observer is also a decider and actor and, in that sense, imposes forms of policy by the very nature of the way she frames observation. This goes further than a sociology of science as developed by Kuhn (Becerra §6).

16. Terms, symbols or images are situated; they acquire meaning through collective use in actual situations. This triadic relationship is also dialogic and has emergent properties of a living language. Flanagan points out:

> A collective sense-making methodology for second-order cybernetics must include provisions for languaging because people use language that is uniquely coded for expressing only certain parts of their immediate needs […] The meanings behind statements need to be decoded and clarified within a consensual linguistic divide so the parties engage in collective sense making can accurately share understandings. (Flanagan §11)

17. Bryony Pierce (§2) sees second-order science as grounded in enaction within a community. This view also resonates with Konstantin Pavlov-Pinus's (§1) positioning of second-order science as bridging between phenomenological and analytical styles of research.

2. Reflexivity and reciprocity

> For the science system in general, the reflexive turn to a mode from within, or an endomode, can yield at least four groups of new opportunities, … (Umpleby §48)

18. For Stuart Umpleby (§7) the essence of second-order science (in so far is it might be captured in one phrase) is "the science of reflexivity." Second-order science is able better to take into account the way that scientific ideas and findings entering the awareness of society change the nature of society and in turn the nature of the science that created the ideas. However, in the absence of recognition of second-order understanding this largely goes unnoticed. This leads to the idea of the study of observing systems. In observing the observed is changed but there is also the feedback of that change to changing the observer.

19. In reflexive systems, observation and intervention are not one-way streets. There is reciprocity between the observer and the world observed. The observer is *participating* in the system and *there are consequences*. Making the observation may not leave the observed in a constant condition. Intervention often creates new conditions (sometimes referred to as unintended consequences), for example in social systems, by provoking new ways of gaming the system. A second-order viewpoint would pay much more attention to this effect and as a result would have to go beyond the conventional categories of first-order thinking. Louis Kauffman (§3) sums up the situation thus:

> A *reflexive domain* is an abstract description of a conversational domain in which cybernetics can occur. Each participant in the reflexive domain is also an actor who transforms that domain. In full reflexivity, each participant is entirely determined by how he or she acts in the domain, and the domain is entirely determined by its participants.

3. Circularity and re-entry

> In the face of the circularity of context and observer it is still possible to explore and come to agreements that have every appearance of being scientific facts. (Kauffman §1)

20. In second-order thinking any stable properties of "the world" are not fixed things but eigenforms. Art Collings (§9) emphasises that circular processes have the property of generating eigenforms that are defined as fixed points in a transformation. From the process perspective, things or objects are eigenforms generated by the circularity of that process. In observing, the observer makes a distinction. The distinction in turn reflects back on the observer. Second-order circularity implies that the condition of the observer is changed by the feedback of the observation. Tatjana Schönwalder-Kunz (§5) also sees science as a self-referential structure that is not simply between observer and observation but in relation to the disciplinary context. The principle of re-entry proposes that any field can be applied to itself as, for example, theory of theory, method of methods, and cybernetics of cybernetics. From a second-order perspective the observer is continuously bringing forth a world and responding to and learning from that world. This stance supports the view that comprehensiveness is impossible. Knowledge is not some static object "out there" but is constantly reforming through the engagement of the knower; and the knower is changed by the encounter with knowledge.

21. Kauffman sees all cybernetics, not just second-order, as inherently circular: "Cybernetics is the study of systems and processes that interact with themselves and produce themselves from themselves" (Kauffman §38). In this sense, all cybernetics is second order. He takes the view that there is no definition of cybernetics that is not circular. Indeed, he takes this further and asserts:

> … all attempts to find stable knowledge of the world are attempts to find theories accompanied by eigenforms in the actual reflexivity of the world into which one is thrown. The world itself is affected by the actions of its participants at all levels. (Kauffman §89)

Such forms are discovered and then codified to become the objective results of that domain of science. A wider perspective on the situation reveals that the larger landscape of the reflexive domain has been significantly influenced by the theories it has given rise to. He concludes that circularity is both legitimate and unavoidable.

4. Reflection and perception

> The subject–object dualism has inherent insoluble contradictions, which make it impossible to come up with an adequate idea about reflection. (Gasparayan §33)

22. It is interesting to me that the development of a science of qualities has not yet entered into the main discourse of second-order cybernetics. This may well relate to the tendency of even this study to be locked into its own roots and language and inadvertently miss out on other parallel explorations that use seemingly different starting points and language. However, there seem to be at least two common elements. One is the attempt to privilege qualities to be as important as quantities and thus challenge the limitations of how measurement is conceived. The other is the presence of the observer in the observation and intervention. Although this is not touched on directly in the work under review there are notable linkage points in the section introduced by Diana Gasparayan on consciousness. She makes the point that consciousness should be present in the study of consciousness and therefore a first-order approach is self-defeating.

> Any attempt to apply the subject-object model to consciousness should be given up, while consciousness should not be seen as a certain objective essence observable by a researcher. It also means that the principles underlying theories of consciousness should be revised: any attempts to explain the mechanism of generating consciousness through non-consciousness should be abandoned. (Gasparayan Abstract)

23. Perhaps a linking area around this question is that of qualia as the characteristics of all and any conscious experience (Pickering §1) including the practice of second-order cybernetics. A science of qualities treats the self-experiencing mind as the primary conscious instrument of the science, prior to the tools of investigation and measurement – microscopes, telescopes, computer modelling and so on. This is essentially the inclusion of the question "how does the scientist/decision maker construct his or her reality?" (Becerra §4).

5. Transdisciplinarity

> A mere call to interdisciplinarity is not enough. What is needed is a new methodology, explicit lines of work, and new tools and techniques easing such integration. (Becerra §15)

24. In the founding of the systems sciences the aspiration was for a universal language of similarities that recurred in many fields. Mathematics is clearly one form of language that has become supplemented by other forms of systems modelling. This has never sat comfortably with the ingrained paradigms of academic institutions. A major necessity for contemporary complexity and uncertainty is the tackling of challenges that cut across traditional disciplines. The fields open for investigation are much broader than most conventional research. Indeed, a key question is: what constitutes a field for investigation?

25. Answers to this question are blown wide open by second-order science, which is more congruent with so-called wicked problems that surface wide fields of connectedness requiring understanding beyond knowledge and data. The perspectives of understanding become critical.

26. First-order science has built its structure of knowledge through specialised disciplines. Transdisciplinarity is an attempt to go under and beyond these distinctions and seek

other forms of insight. From the perspective of Jean Piaget's genetic epistemology, Rolando Garcia (Becerra §14) suggests that improvement of approaches to complex problems requires integration of different aspects of knowledge and to construct the study object among multi-disciplinary team members.

6. Multi-perspectival dialogic

> Interdisciplinary perspective is not a matter of theoretical reconciliations, but rather it is a co-construction of new theory through the reconfiguration of meaning drawn from joint consideration of primary observations. (Flanagan §3)

27. A key component of second-order method is its accommodation of emergent processes and emergent findings, some of which may be created in the process of application. An interesting illustration of this is provided in Tom Scholte's incorporation of Gordon Pask's conversation theory as a key component in the process in theatre research of Active Analysis. Conversations regarding circumstances and objectives of the selected drama are followed by active improvisation to be followed by a second conversation from the observer/participant perspective. This in turn re-enters and reframes the original conversation. It could well be that this approach generated in the context of the theatre is also applicable in the theatres of action of other sciences. In some ways it reflects more congruently the live experience of research. Eva Buchinger (§5) also proposes that Pask integrated with Niklas Luhmann as a way of conceptual integration between disciplines. A comparison with dialogical design science would also shed further light on this (Bausch & Flanagan 2013).

28. In dealing with complex situations that do not yield to a single discipline it is valuable to take several perspectives. The process of dialogue around a question from a number of disciplinary or stakeholder perspectives enables a creative emergence.

29. Allenna Leonard (§4) emphasises that these approaches provided a field for the emergence of second-order cybernetics allowing for multiple constructs of stakeholder positions in different cultural and social contexts. Such background must lead to the challenging of existing power relationships in both the scientific communities and their managerial communities.

7. Intervention and ethics

> The associated ethics and responsibilities that arise out of second-order cybernetics may be overwhelming. This is an unsettling no-man's land for many scholars and students, who in turn opt out of this challenging reflexive epistemological domain. (Baron §8)

30. The observer is not merely an observer. We can substitute terms like actor, decider, and intervenor. From an enactive second-order perspective, in a world that is highly structurally coupled, there can be no such thing as a totally detached observer. Any position (even that of a decision not to observe) is an intervention. Assumptions are being made based on values and judgements as to what is "in" and what is "out" of consideration. Yet these judgements are often invisible and remain unquestioned, leaving research as a methodological game played on a field where the game itself is taken as objective and unquestioned. An implication for policy is that the use of "objective evidence" is at risk of being interpreted and used as an argument for political ends without making clear the value assumptions behind its supposed objectivity. A complementary second-order disci-

pline would seek to make clear the position assumed by the objectivity of the research. It is interesting that the primary reference for the place of ethics is still von Foerster's (1997) often-cited work. This has not been very well developed and is of paramount relevance to the relationship between social responsibility and science, a relationship the first-order culture of science has great difficulty in making sense of. Some explorations of ethics and second-order cybernetics in decision making were explored by Hodgson (2010).

31. Making a distinction is making an intervention. This act defines content but, as Lissack (§3) points out, context always matters. Although not a contributor to this book there is much that could be brought to bear here from Gerald Midgley's (Midgley & Ochoa-Arias 2001) work on systemic intervention and boundary critique. The very nature of second-order science implies that consideration of ethical dimensions is essential to a full methodology.

> Clearly, there are ethical repercussions from seeking to understand a second-order science that includes the observer and, by extension, the environments to which the observer is structurally coupled. (Forsythe §18)

Towards a conscious methodology

> SOC is considered an instance of building a new and general methodology of science that is not linked exclusively to cybernetics but that can be utilized across all scientific disciplines and for a variety of applied disciplines, and that can be extended to cover the arts as well. (Müller & Riegler: Abstract)

32. Can an operation of re-entry here contribute useful perspectives to research in practice? I am thinking of two fields of practical relevance. The first area is early career researchers, PhD students who are attracted to explore the second-order paradigm and wish to conduct a piece of research that is intentionally and deliberately second-order, and significantly, explicitly so in general terms beyond any specialist discipline that might be its field of research. Many will recognise the typical actual experience reported by Michael Hohl:

> Told as a story, my research appears pretty straightforward and top-down. In fact it was bottom-up and came together step-by-step over three years. The research process was a constant learning process. (Hohl §5)

33. The second area is that of policy making where there is increasing questioning of the limits of evidence-based policy, where the evidence is based on first-order science and yet the application is in the world of complexity and uncertainty of the society and its politics. Consider applying to policy development as well as design the following statement by Jose dos Santos Cabral Filho:

> A significant advance in design towards a second-order level will come when designers embrace an all-encompassing systemic approach that will necessarily have the inclusion of the observer, at all possible levels, as its pivotal point. (Cabral §11)

34. The elements of both design practice (Scholte-Halprin §12) and naturalist theatre (Scholte §3) can provide suggestions as to how innovative second-order ways of going about policy in a complex world with emergent properties might be tackled.

35. The facilitation of shared exploratory thinking in groups, especially using visual thinking, has direct parallels with digital design (van Stralen §4) and the summary points that Ben Sweeting (§22) highlights, namely:

- Reflective conversation
- Forward looking research
- Use of drawings and models as a part of thinking
- Importance of participation
- Circular reflective process
- Reciprocal relationship

The implications for human affairs

> The governance of the contemporary world and the interconnections among governance, democracy and knowledge are far more complex than most observers recognize. No single level is decisive in shaping the world in which we live. (Stingl §10)

36. The predominant view of scientists in society is that first-order research is paramount and that if implementation was not going well it was not a scientific problem and so a problem for scientists. Umpleby strongly points out that this is no longer tenable:

> The present time is characterized by an abundance of societal and environmental problems locally, nationally, and globally, where a high accumulation of theoretical scientific knowledge is accompanied by a deep deficiency in extension, implementation, or transformational knowledge. (Umpleby §56)

37. He sees the emergence of second-order science as one contribution to redressing this problem in creating better channels between science and practical human affairs especially in the social and environmental domains.[5]

38. Substitute the word "policy" for "design" in Sweeting's statement (§8) "…design involves the creation of new situations, design questions cannot be fully formulated in advance but shift and change as they are explored and as proposals are enacted" this description would most likely be agreed by policy researchers.

39. Some further areas for research that the progressive policy community might consider are:

- Recursion of many levels; character and eigenvalue (Clark & Chansky §9)
- Outside and inside (Landgraf §7)
- Theatre is uniquely positioned to provide methods and tools to understand consequences of differing configurations forming perception and conception. (Christy §18)
- Caution in transferring from one context to another (Müller §4)

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5. A second-order approach to research in socio-ecological transformation is being pursued by Ioan Fazey, Professor of the Social Dimensions of Environmental Change at the University of Dundee. This includes a series of conferences on "Transformation in Practice" http://www.transformations2017.org/30/12/16

- Cybernetic theatre for exploring policy (moving on from Sweeting §5; Richards [The Many Varieties of Experimentation in Second-Order Cybernetics] §4)

40. Of course, there are what may amount to intractable problems in all this for the status quo culture. For example, recognising circularity in learning, cognition, problem solving, etc., does not by itself change a rootedness in linear causality (Martin §11). In my view, mainstream deterministic science is a special case of second order in which the community of scientists (and their political sponsors) have implicitly agreed to remain ignorant (or to suppress) that the experiencer is "hidden in plain sight." Two tricky areas are:

- SOC challenges the dominant paradigm of power and control (Martin §21) where evidence-based policy is limited to that of first-order science
- Aspects of the theories that are held become engaged with and engaged by power and shape the subterranean assumptions that drive policy behaviour (Bohinc §4).

41. Nevertheless, in conclusion, I suggest that there is potential value in research into the relationship between second-order science and policy development, which could contribute to a number of areas including:

- Providing a common language of engagement for collaboration between "hard" and "soft" sciences and policy development that includes explicit ethics
- Providing a meta-framing for exchange across the disciplines of sciences, humanities and the arts, and design more congruent with wicked problems
- Providing some possible underpinnings for the limitations and possibilities of any discipline's contribution to societal transformation more clearly with transparency of assumptions
- Doing all this in a manner that renders the ethics of human activity transparent

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