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Book Review

Simultaneity: Temporal Structures and Observer Perspectives, edited by Suzanne Vrobel, Otto Rössler, and Terry Marks-Tarlow. Singapore: World Scientific, 2008.

> *Love, all alike, no season knows, nor clime, nor hours, days, months, which are the rags of time.* – John Donne

This hefty, edited volume of papers on time, simultaneity, and implications for the observer perspective is certain to intellectually stimulate, intrigue, but also to beguile and even infuriate at times. Both the wide range of topics and the proficiency by which they are handled are characterized by so much variance the book as a whole eludes a crisp assessment. Nevertheless, because of its plethora of rich speculations with phalanges into so many fascinating conceptual territories, my overall impression is very positive. Can I get away with saying this book covers a whole lot of new territory simultaneously! I will even hazard to guess that this volume will be looked back upon as a pioneering work.

Although it might seem at first to be in the genre of philosophies of time (e.g., Gallagher, 1998; Sprigge, 1993), instead it is more appropriately understood as a compendium of speculations involving temporality from a host of perspectives such as dynamical systems, neurosciences, particularly cognitive science, physics, physiology, chemistry, psychotherapy, public policy analysis, and yes, even philosophy. While many writers' names will be familiar to readers of *NDPLS*, many more will not.

The chapters are related more by a kind of Wittgensteinian family resemblance than be some sort of more explicit linkage. This means that some chapters will appear to have little to do with others yet will still have something to do with the overall themes. Moreover, because of the book's great variety, I couldn't possibly do justice to them all. Instead, I will concentrate on just a few, selected ones, chosen more according to this reviewer's predilections than for being supposedly representative of the book.

FRACTAL STRUCTURE OF TIME AND TEMPORAL SCALING

The most salient theme of the book, instigated by the lead editor Susie Vrobel in her opening chapter and explored in more or less direct fashion throughout, concerns understanding time as fractal in structure and thus inherently involving scaling. This view of time is very much at odds with the

usual "flowing river" metaphor of temporality which goes back at least as far as Heraclitus' declaration that we can't step into the same river twice. Aristotle informs us that the later Heraclitian philosopher Cratylus went even further by protesting we couldn't put our foot into the same river even once! (Barnes, 1982). Not surprisingly we also learn that Cratylus spent his latter days in total silence, occasionally moving a finger like an Ancient Grecian Zen master!

To the extent that we think of time as a river, we are committed to a uni-dimensional and uni-directional understanding of time's structure, that is, a river flowing in only one direction from past to present to future. Not long ago, though, I was walking along a tidal estuary with a briskly flowing current on the outgoing tide, in the process of which a wonderful burbling, gurgling sound can be heard. Standing on a little wood bridge over this flowing current, I closed my eyes, and listening attentively noticed something quite remarkable: the burbling, gurgling sound was multi-dimensional in that it was spread out across a kind of *spatial and temporal field* of sound, with different sections of this field containing different rippling sounds and at different times. Rather than a unidirectional, lineal stream of sounds, I heard a kind of multi-dimensionality of sound, both spatially and temporally.

This sense of the current's multidimensionality can be carried over to Vrobel's idea of a fractal structure of time where temporality is understood as multi-dimensional, multi-layered, and multi-ordinal. Vrobel posits three dimensions for this fractal structure of time: the *length* of time defined as the succession of temporal moments or events; the *depth* of time defined as a measure of the number of simultaneous temporal moments, what Vrobel terms "during-relations" (bringing to mind Bergson's *durée*); and the *density* of time which measures the relation between successive and simultaneous events. Temporal density connects time's length and depth and since length is about succession and depth about simultaneity, an observer/participant cannot experience length and depth at the same time. The structure of the experiential "Now" is understood as a nested cascade of memory in which simultaneity arises from a superposition of levels of description. Vrobel claims music as an example where the fractal nature of time allows allows for the embedded and the embedding to be transposed into one another leading to musical consonance.

That time is constituted by this nested fractal structure allows Vrobel to look afresh at the different temporal scales of nature (our own experience included) such as how "tidal rhythms are embedded into seasonal rhythms, which again, are embedded in astronomical ones. Within the observer, for example, neural oscillations are embedded into much slower metabolic ones." These observations also support the view that the more complex the observer participant's internal differentiation, the higher is his/her empathic skills, i.e., ability to simulate and contextualize what happens in the external world.

The next chapter by Otto Rössler (of Rössler attractor fame) takes this theme of a fractal structure of time and soars on a wild flight of speculation involving what the brain and cognition would need to be like if time indeed is fractal in Vrobel's sense. Using the image of the "Great Simulator," Rössler

utilizes temporal fracticality to explain bewildering aspects of memory such as why our experience simply does not always fade away in "exponential decay" from the Now. He offers the idea of a kind of cognitive "overlap buffer" which allows for several different temporal patterns to be superimposed simultaneously. Rössler also appeals to music expressing a superposition of self-similar waves of differing lengths: "A maximally simple example is the famous, always increasing but never really increasing in pitch, sequence of musical chords."

Rössler even offers a possible experiment to demonstrate the hypothesis of a fractal structured temporality: every second time segment of a musical signal (of ten seconds duration) "is obliterated by acoustic and optical noise while the other (non-obliterated) segment in between is recorded and played back inverted in time to the experimental subject, in an interactive fashion under a combined mechanical, acoustical and optical coupling while the subject is standing on a running belt with fixed handrails." He asks, "Will the first volunteer for this experiment find it to be a perfect analog to the famous 'inverted-spectacles' experiment of earlier times?"

From a cognitive vantage point, the chapter by Ramseyer and Tschacher emphasize nonverbal temporal synchrony in human communication as shown, for example, in dyadic psychotherapy. The authors suggest a new research method based on an automated video-analysis algorithm. With this new method they can explore any correlations between nonverbal synchrony and the quality of the therapeutic process.

From a neuroscience perspective, Emrich, Bonnemann, and Dietrich suggest envisaging the brain as a kind of "time machine" since, as a neuro-biological-physiological system, it is constituted by neurochemical oscillators which subjects it to chronobiology. Like Rössler, they also point to memory as a key place where the scaling view of time is operative as brain memorizes "stored regularities" as well as exhibiting a capacity for what Husserl called "protension" or the ability to anticipate the future.

Van Nieuwenhuijze expands from the brain to include the entire functioning of the human body in which each cell in effect has its own time base. This temporal multi-dimensionality of physiology shows up in recent findings concerning dynamical understandings of disease and health.

From a more everyday point of view, Marks-Tarlow emphasizes how cognition is enhanced by fractal time in that a nesting of temporal intervals of various lengths can allow us to be attuned to the whole of a project while simultaneously able to be immersed in the moment.

Koehler's chapter puts forth the thesis of an overall "time-ecology" of nature playing off of Fraser's proposal that there are five stable, hierarchically nested temporal levels each with its own type of causation. In Koehler's view of temporal scaling, each "local" event has its own dynamical pacing, temporal perspective, and temporal progression, all of which are embedded in biotemporality as in Van Nieuwenhuijze's chapter. From any local situation within this "time-ecology" which possesses "no unforgiving central clock", it is instead the temporal priority between two events which determines the direction

of causation, an idea that brought to this reviewer's mind Hume's famous understanding of causality.

Temporal ecology also characterizes the approach taken by Allen who interprets evolution as made possible by the "partial separation of time-scales" which in turn allows for the generation of micro-diversity within systems on a shorter term scale. Selection works by means of the "different temporal scales that emerge." "Evolution is messy" because of the differences in time scales and the varied rates of micro-diversity, but each new emergent level does provide a kind of protection within which exploration can occur. Allen's idea of a shield between levels brings to mind the Nobel Laureate Robert Laughlin's (2006) notion of "quantum protectorates" which shield higher level emergent structures from lower level micro effects. Allen warns, however, that no matter how stable we believe emergent structures are, this can only be a short term view since it fails as an indication of the potential for the kind of instability leading to structural change. Here this reviewer could not help but think of the current world-wide financial crisis where the financial "pundits" seem bound to simplistic equilibrium-based views of the economy. A little sense of the incredibly diverse temporal scaling involved in the global economy would be most welcome (see Bookstaber, 2007).

From a more technical mathematical perspective, Nottale and Timar offer a "theory of scale relativity" with the implication that scales of both length and of time are relative matters arising from the ratio between an external scale and an internal scale; indeed, the very geometry of space-time is constituted by this scale relativity. To further their project, the authors propose the development of specific scaling "laws". These were very intriguing speculations for this reviewer since I had never before thought of gauge theories (or symmetries) as applicable to temporal scaling and not just spatial scales.

CONCLUSION

It is impossible to do justice to the range of this book and there are many more fascinating chapters than the ones I selected to write about. Time is, of course, a central concern to nonlinear dynamical systems, "temporality" embedded in the very meaning of "dynamical". Even in "pure" philosophy, models have been used in which temporal considerations tend to sneak in even when the basic conceptual structure is logic itself (see Goldstein, 2001).

All the speculations in this book aim at shifting our inherited or commonsensical ideas about time and therefore the book can be said to be mind stretching if not always entirely credible. Although some speculations are put forward as if they were actual scientific hypotheses, I do not think most need be taken as such. In any case, this book will surely be talked about, its issues debated in a host of different scientific and philosophical fields, with the result that our accepted views of time will never be the same.

One point, a minor one but I feel it should be mentioned, there is a curious lack in this book involving the theme of simultaneity: there is little

mention made of either Einstein's or Poincare's ground-breaking insights concerning the whole notion of simultaneity (see, e.g., Galison, 2003).

As I said at the beginning of this review, the book can also be infuriating at times. This was my response, for example, to one of the articles which for the sake of fairness I'll not reveal either its title or author. Suffice it to say, that the author puts forward a thesis which I would characterize as leaving the realm of what is cogent by relying on interpretations of certain theories in physics and findings from astronomy which are flimsy at best, what some may even consider to be "crank" science. For example, one chapter relies on the most outlandish interpretation of a theory in physics, an interpretation which the progenitors of the theory themselves even repudiated (for an exposition of what this theory means see; for an exposition, see Price (1991, 1994) and Leeds (1994, 1995). The same chapter also appeals to certain astronomical findings which have not received verification. In the opinion of this reviewer, this chapter makes the conceptual error analogous to a first year medical student interpreting a hoof mark as a sign of a zebra whereas a professor of medicine would more soundly see the presence of a horse instead. There may indeed be a Wizard of Oz, but eventually, there will be a Dorothy who comes along and uncovers the truth about the cranky old man behind it all.

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