Short Communication

REALITY GENERATION: THE FRACTAL TEMPORAL PERSPECTIVE

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Introduction

This paper describes the significance which the structure of the observer's Now can be assigned in time series analysis and ways of modifying the observer's interface.

Time series analysis is usually carried out in retrospect, i.e., we look at a string of data or a plotted graph well after that data was gathered or the event was observed. Direct observation in (almost) real time is usually limited to a succession of temporal events on one level of description (LOD): We cannot detect temporal scaling, e.g., in the self-similar patterns of fore-main- and aftershocks in seismographic data in real time (1). Scaling temporal patterns also occur throughout the living world (2) and are therefore a promising candidate for a differentiated time series analysis which takes account of the interfacial structure of the observer.

Direct, real-time observation takes place in the observer's interface with the world – the Now. This fleeting moment he experiences as a whole, meaningful entity is his only window to the world. So, if an observer wanted to directly observe a temporal scaling pattern in real time – how would this observer's Now need to be structured?

The nested structure of the Now

The German philosopher Edmund Husserl (3) describes the structure of the Now in a phenomenological approach: When we listen to a tune, we hear a succession of musical notes. But we do not perceive simply a succession of unrelated notes - we are able to hear a tune. How come?

We internally connect the note we have just heard with the present one and the tone we anticipate to follow it. Through repeated acts of remembering a tone (retension) and anticipating the next tone (protension) within the memory of the present (Now), we create and are able to perceive a nested temporal pattern within the Now. Thus, the observer creates a simultaneity of retension, the consciousness of the present and protension, all within the Now.

Without memory of the preceding note and no anticipation of the next one, an observer would only perceive a succession of isolated, unrelated notes. But as we are able to perceive a tune and not just a succession of isolated notes, we must assume the Now to provide for both succession and simultaneity.

Succession and simultaneity within the Now generate a nested, fractal structure. It is this extended structure of the Now we have to assume to explain our ability to perceive a tune or any other time series as a meaningful entity.

Let us therefore assume the structure of the Now to be a nested one which contains not only successive events but also temporarily overlapping ones which add the dimension of simultaneity to that of succession. This simultaneity creates a framework time which groups otherwise isolated events into a before and after relation. Without simultaneity, no before and after relations, no related succession, would be possible.

The observer does not generate time, but through his choice of nestings, he generates the structure of the Now.

Fractal Time: Fractal and non-fractal observers

In my Theory of Fractal Time (4), I have taken account of the observer's nested Now by differentiating between

- Δt_{length}, the length of time, which is the number of incompatible temporal extensions in a time series. Δt_{length} describes the succession of events on one LOD.
- Δt_{depth}, the depth of time, which is the number of compatible temporal extensions in a time series and, therefore, the number of LODs. Δt_{depth} reflects simultaneity and provides the framework time which allows us to structure events in Δt_{length}.
  N.B.: Without Δt_{depth}, there is no Δt_{length}!
- $\Delta t_{density}$, the fractal dimension of time, which describes the temporal density of a time series.

A non-fractal observer, who can perceive only isolated notes in a tune or isolated events in a time series, would only be able to observe successive events. Simultaneity and memory formation would be unknown to him, as he would not be able to generate a Temporal Fractal Perspective through continuous nesting. He would live in an eternal succession of unconnected Nows, in which no learning or reflection could take place.

A fractal observer, on the other hand, is able to observe events on a number of LODs. This allows him to generate a Temporal Fractal Perspective, observing succession and simultaneity of events directly, in real time (5).

The Now is an interface between the observer and the world (6). Apart from individuals who are impaired, e.g., by a neurodegenerative disease, we are all fractal observers and see both succession and simultaneity.

Our awareness of this nested perspective, however, appears to be rather limited. It is only when we encounter tangled hierarchies or simply curiosities that the existence of both nested and non-nested perspectives may dawn on us. One such curiosity is the name of the yesterday, today, tomorrow shrub. Its blossoms change within days from deep violet-blue to a light blue and finally to white. As this development is staggered, the shrub always displays blossoms of all three colours. The person who gave the plant its name seems to have looked at it on at least two LODs: on both the plant as a whole, as well as at its individual blossoms, that is, through a fractal interface, a nested Now.

A non-fractal observer who looks at the blossoms of the shrub and their individual development through the successive colours on only one LOD would not come up with a name like yesterday, today, tomorrow. Only a nested interface providing for both simultaneity and succession can generate a Temporal Fractal Perspective, which makes someone refer to the past, the present and the future in the Now.

Temporal Natural Constraints (TNC): The Prime

An observer with a Temporal Fractal Perspective may identify scaling structures, i.e., structures which appear on various nested LODs. Scaling is usually a limited property, i.e., there is an "outer" LOD, which hosts the structure covering the largest interval in Δt_{length} and an "inner" LOD with the structure covering the shortest interval in Δt_{length}.

Within such a self-similar domain, we can describe a limitation on the structurability of time by the observer, a Temporal Natural Constraint (TNC): the Prime.

The Prime is the most basic temporal unit within a scaling system - the smallest unit of time which contains the structure recurring on all LODs. It is extended but indivisible in the sense that it cannot contain further nestings.

These smallest, indivisible units of time allow us to relate the nested LODs to each other through their recurring structure. If we set the recurring structure of the Prime as a constant, this Prime Structure Constant provides a translation tool between the LODs of the self-similar domain (7).

Condensation

If the Prime of a temporal structure is set as a constant, the lengths of time Δt_{length}, are condensed on all LODs, to varying degrees. Large intervals of Δt_{length} shrink to a fraction of their original temporal extension. (Imagine superimposing the Prime structures of all LODs – the yardsticks of the various LODs would be condensed.) Condensation occurs for fractal observers only.

For a fractal observer, this condensation generates an extension of the Now, as previously large intervals of t□ length shrink to the extension of the Prime, that smallest, indivisible unit of time.

The Temporal Fractal Perspective is generated by a fractal observer whose Now is differentiated by nested LODs with self-similar structures. As a fractal observer can make out correlations between both successive and simultaneous events in real time, he can, after identifying a Prime, set it as a constant. After the structure of his interface (his Now) has been changed in this way, it now contains the Prime Structure Constant, which enables him to observe a condensed version of originally long intervals in Δt_{length}.

The temporal fractal interface

The Now is our only access to the world. It is the interface between the observer and the system under observation. Non-fractal and fractal observers have generated differently structured Nows, i.e., differently structured interfaces.

As a result, non-fractal and fractal observers obtain different observational results when analyzing a time series. Therefore, we have to take account of the structure of the observer's Now (interface) when we analyse a time series.

"Conventional" retrospect Times Series Analysis can be regarded as a special case of a more general method of Times Series Analysis which differentiates between various structures of the observer's interfacial structures.

In general, we can assume temporal extensions of Δt_{length} of an event to vary, with their individual extensions depending on the observer's Temporal Fractal Perspective.

If two or more observers agreed to modify their interfaces by generating the same number of nested LODs containing the same Prime Structure Constant, the Primes of these interfaces would not only be translation tools between LODs, but also between the interfaces (Nows) of individuals. Shared Primes may also be the result of a selection process. In this case, we should look out for universal Primes.

Universal TNCs

Universal Primes or other TNCs are very probably all around us, rendering possible successful communication as the result of a selection effect. They should be accessible to and shared by a number of fractal observers (if not to all). If this is so, it is likely that we are familiar with them but do not recognize them as Primes.

TNCs need not exhaust themselves in Primes, but could also take the shape of a transition rule (from one LOD to the next). Candidates for such transition rules could be t□ depth-analogues to known constants which refer to Δt_{length}, e.g., a Δt_{depth}-analogue to Feigenbaum's number (8).

Universal TNCs could reveal "objective" distortions in time (in Δt_{length}), if an experiment showed the existence of a temporal illusion as a result of our Temporal Fractal Perspective. This would require a comparison of observational results of fractal and non-fractal observers.

The observer's role: Reality generation

Whether or not there are universal TNCs, individual Temporal Fractal Perspectives can be modified by altering the number of LODs available to the observer (9). This is achieved by means of nesting and de-nesting: Nesting involves the generation of further LODs to increase Δt_{depth}. It further differentiates the observer's Temporal Fractal Perspective. De-nesting takes place when LODs are erased from the observer's Now. An individual left with only one LOD lives in an eternal succession of unconnected, unrelated Nows.

The increasing influence of the observer in the evolving paradigms of time could be shown to start by the replacing of Newtonian absolute time by Einstein's relative concept of time, which allows for observer frames.

Next, quantum mechanics suggests that there is no such thing as an independent observer of reality. The observer or the measuring device participates in the generation of reality.

Rössler's Micro-constructivism (10) introduces an observer-world interface: the Now. As the observer cannot be taken out of the objective structure of the world he wishes to observe, we have to take account of his internal microscopic movements, which alter his interface, his Now. Only a super-observer located outside the system could perceive it without the interfacial distortions people within the system have to put up with. But observers who are part of the system they wish to observe face a Gödel-limit. It is a Strange Loop in Hofstadter's sense (11).

We may, however, modify the structures of our Nows, our interfaces, by nesting or de-nesting, and by extending our Nows by means of condensation.

To conclude, every Time Series Analysis requires a case differentiation in which we state what type of observer is assumed. This is essential, as fractal and non-fractal observers generate very different realities.

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