Nesting Performances Generate Simultaneity: Towards a Definition of Interface Complexity

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Abstract

In a phenomenological approach, correction processes underlying visual and auditory illusions are interpreted as effects resulting from contextualization. It is proposed that these correction processes are nestings generated by the fractal temporal interface between the observer and the world.

To measure embedding contexts, the relative measure of interface complexity is introduced. The observer's temporal interface, the Now, is presented as a modifiable structure which determines the degree of interface complexity. The degree of interface complexity is determined by the amount of matching nesting structures inside and outside the observer. It is suggested that nestings are the result of the use of context and the notion of simultaneity is the result of nesting processes.

Based on the Theory of Fractal Time, observer types who generate nested and non-nested perspectives are defined. It is suggested that certain disorders may be reinterpreted as *interfacial misfits* if inside and outside simultaneity are not in a one-to-one mapping.

By means of nesting and de-nesting, the temporal interfacial structure may be optimized. Increased congruence between inside and outside simultaneity facilitates successful navigation through the world.

Possible applications of the *interfacial misfit* model range from therapeutic options and meditation techniques to risk analysis and custom-made encryption.

1 Introduction

There exist a large number of concepts of complexity, none of which, however, take account of both the endo- and the exo-perspective of a system (the inside and the outside view) and the observer's internal differentiation. The new field of interfaciology defines the world-observer interface from an endophysical perspective. This considers the views both from the inside and the outside, including the observer's internal differentiation on the microscopic level [Rössler, 1995, 1998]. This paper focusses on the macroscopic manifestations of the observer's internal differentiation.

To introduce a concept of complexity which is suitable for portraying this differentiation as well as the impacts of inside and outside (endo- and exo-) effects, which shape the observer-world interface, the notion of interface complexity is defined. Interface complexity is a relative measure, which may be determined as a result of identifying correction processes. Correction processes are induced by embedding contexts. As these processes are part of the observer-participant, it is the observer's internal differentiation, in particular his temporal interface, the Now, which determines the degree of complexity measured on the observer-world interface.

In a phenomenological approach, correction processes underlying temporal or spatial (i.e. visual and auditory) illusions are interpreted as effects resulting from contextualization. It is proposed that these correction processes which underly illusions – spatial or temporal distortions - are nestings generated by the fractal temporal interface between the observer and the world.

The degree of interface complexity is determined by the amount of matching nesting structures inside and outside the observer. It is suggested that nestings are the result of the use of context. The notion of simultaneity is shown to be the result of nesting processes.

Based on the Theory of Fractal Time [Vrobel, 1998], a differentiation between fractal and non-fractal observer types is proposed, who generate nested and non-nested perspectives, respectively. The observer is capable of modifying the structure of his temporal fractal interface by nesting and de-nesting activities. This may be desirable for individuals whose degrees of freedom are limited as a result of insufficient nesting capacity. Individuals suffering from schizophrenia or depression tend to perform better in de-nesting activities than control group subjects. Their failure to use context, i.e. to nest events, enables them to spot visual illusions which control group subjects are fooled by. Against this background, it is suggested that disorders such as depression and schizophrenia may be grouped in terms of their degree of interface complexity. They may be reinterpreted as *interfacial misfits*, as simultaneity on the inside and simultaneity on the outside are not in a one-to-one mapping.

The advantage of the *interfacial misfits* description lies in the therapeutic options arising from this interpretation. Nesting and de-nesting exercises are suggested by means of which the observer can modify the temporal structure of his interface so as to optimize the relation between inside and outside simultaneity. The more congruent these two become, the easier it will be for the observer to successfully navigate through the world.

Meditation techniques based on nesting and de-nesting exercises provide a tool for synchronizing inside and outside simultaneity. These may be practiced not only in order to remedy existing interfacial misfits but also as a preventive measure.

Apart from a new therapeutic approach for medical disorders, the notion of an *interfacial misfit* may also be applied in risk analysis, where subjective and objective estimates of risk generally vary greatly. Here, too, simultaneity on the inside (subjective estimate) and simultaneity on the outside (objective estimate) are not in a one-to-one mapping. Understanding the nesting/embedding performances carried out by individuals when they use context could help anticipate their risk behaviour.

Another possible field of application of the interfacial misfit model is custom-made encryption. The identification of context splits a perception into signal and noise. As nested contextualisation may be trained, observer types or individual observers will – after initial exposure - always reinterpret a perception in the same way regarding an recognized structure and its embedding context - signal and noise.

2 Correction Processes

Complexity may be defined as a measure which is determined by the structure of the observer's Now – his present and only window to the world [Vrobel, 2005c]. The structure of the observer's Now is shaped by (among other pattern-forming constraints) correction processes. For my purposes, correction processes which underlie visual and auditory illusions are a convenient starting point. To begin with, I shall briefly introduce a correction process underlying a visual illusion and draw an analogy with a correction process underlying an auditory illusion.

We tend to see familiar objects as having standard shape, size, colour or location, even when the perspective, distance or lighting changes (e.g. a car approaching us fast while we are walking towards it on the roadside). Our impression tends to conform to the object as it is or is assumed to be, rather than to the actual stimulus. This perceptional constancy makes it possible for us to identify objects under varying conditions. Apparently, we take these conditions into account when we process and interpret our perceptions.

This stability in perception seems to be persistent despite the fact that there is considerable instability in the stimulation. We take distance and relative size into account when we observe an object in its surroundings: For example, we see objects as of the same size at different distances because they stay the same size relative to surrounding objects. We are usually not aware of this internal correction process – unless, of course, objects of the same size are not of the same size relative to surrounding objects - then we experience the so-called *corridor illusion* (see Figure 1).

A case-differentiation for different types of observers is necessary here: It is important to remember that the truth value of the observer's communicated perception of the corridor illusion depends on the levels of description (LODs) available to this observer: It depends on whether the observer interprets the 2-dimensional visual representation as a 2-dimensional or a 3-dimensional object.

The corridor illusion only occurs if the 2-dimensional object is interpreted as a 3-dimensional one, i.e., against the background of an additional LOD which the observer has generated. An observer who does not have the ability to fall back on such an embedding LOD sees the three men as being of the same size, without reference to the corridor perspective.

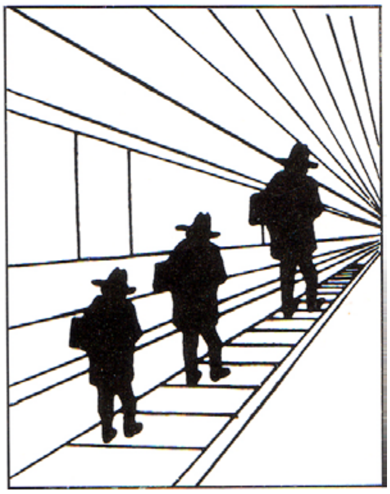

Figure 1 [Hamm, 1988]

Visual and auditory illusions with underlying correction processes facilitate compatibility with the outside world. As "successful" observers, we interpret the 2-dimensional representation as a 3-dimensional one and thus experience a (visual) illusion: We perceive the three men in the corridor as being of different sizes as a result of their relative positions to the background, which we take into account. If we did not add this (physically non-existent) dimension, we would not experience the illusion. This acquired perspective may be misleading in the "correct" estimation of the size of the three men in the corridor illusion. In our everyday lives, however, our 3-dimensional perspective allows us to successfully interpret and navigate through the world.

Auditory illusions such as the Shepard scale are also based on underlying correction processes: "A *Shepard tone* is a sound consisting of a superposition of tones separated by octaves. When played with the base pitch of the tone moving upward or downward, it is referred to as the *Shepard scale*. This creates the auditory illusion of a tone that continually ascends or descends in pitch. (...) This can be constructed by creating a series of overlapping ascending or descending scales (...) Overlapping notes that play at the same time should be exactly an octave apart, and each scale should fade in and fade out, so that it is impossible to hear the beginning or end of any given scale." [Anon., 2005]

The scaling structure of the discrete Shepard scale prompts an auditory illusion because the listener focuses only on pitch relations and thereby tries to extract a one-dimensional signal from a multi-layered one.

If the signal is multi-layered and nested to start with, a multi-layered, nested interface will simplify the signal for the listener. By differentiating the layers, the listener will not perceive an auditory illusion. He will be able to hear distinguishable parallel tone sequences [Vrobel, 2005d]. If we may thus assume that correction processes underlying auditory illusions appear to change the structure of the observer's Now, his interface with the world, the next question to consider is: How does an observer's Now need to be structured in order to perceive an auditory illusion?

Before attempting to answer this question, consider another example of a nested signal – this time in the form of a visual simultaneous input. Dakin et al carried out an experiment in which schizophrenics and healthy test subjects were exposed to a simultaneous contrast (see Figure 2). They were asked to match the small disc nested in the larger, higher-contrast disc with the peripheral disc which apeared to be the best match. Healthy subjects tended to fall for the visual illusion induced by the simultaneous contrast (to them, the central disc appears to be of lower contrast, as the embedding, larger disc of higher contrast influences their perception of the embedded disc). Schizophrenics performed better: they did not fall for the visual illusion, as they did not contextualize the nested disc, i.e. the outer high-contrast disc did not modify their perception of the nested one. In this case, schizophrenics' failure to use context worked to their advantage: they correctly matched the inner disc with the disc at 6 o'clock, whereas healthy subjects who could not inhibit contextualization matched the inner disc with the one at 10 o'clock [Dakin et al, 2005]. Just as for the auditory illusion, the visual illusion was brought about by an (unconscious) nesting performance. Contextualization helps us in most cases to navigate the world successfully, but it also shows how distorted our interpretation of simultaneous signals becomes as a result of this nesting performance.

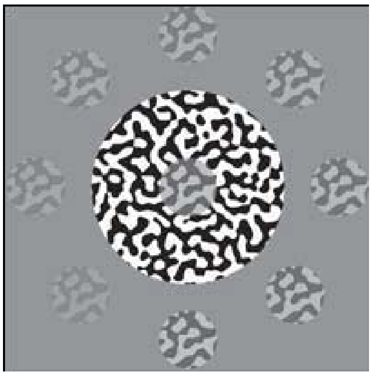

Figure 2 [Dakin et al, 2005]

Against the background of the nesting underlying these auditory and visual illusions, it seems that the observer's Now must allow for contextualization, i.e. it must be extended to be able to host nested simultaneous structures. As we are also able to follow a rising or descending pitch, the Now must also allow for successive events to be available in context. The following example shows how an extended Now which hosts both simultaneity and succession may be structured.

3 The Observer's Extended Now

A nested structure within the Now would make it a fractal. (A fractal is a spatial or temporal structure which exhibits detail on many levels of description – by zooming into the structure, more and more detail appears.) In this paper, it is proposed that this fractal structure is generated by the observer and the world around him. This assumption is based on the following considerations. The German philosopher Edmund Husserl first described a nested structure of the Now [Husserl, 1928]. He pointed out that 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 hear a tune. We are able to do this because we internally connect the note we have just heard with the present one and the tone we anticipate to follow it. But we do not connect them in an arbitrary way: we remember a tone (*retension*) and anticipate the next tone (*protension*) within the consciousness of the present, the Now. As we do this over and over, we create a nested temporal pattern within the Now. Without memory of the preceding note and no anticipation of the next one, we would only perceive a succession of isolated, unrelated notes. But as we are able to perceive a tune as opposed to a succession of isolated notes, we must assume the Now to host *both* succession and simultaneity. Succession and simultaneity within the Now generate a nested, fractal structure. In order to explain our ability to perceive a tune or any other time series as a meaningful entity, we must assume the observer's Now to have extension and a nested structure.

4 Fractal Time

My Theory of Fractal Time [Vrobel, 1998], takes account of the observer's nested Now by differentiating between Δt_{length}, Δt_{depth}, and $\Delta t_{density}$.

- Δt_{length}, the length of time, is the number of incompatible temporal extensions in a time series. It measures the succession of events on one LOD.
- Δt_{depth}, the depth of time, is the number of compatible temporal extensions in a time series. It measures simultaneity and provides the framework time which allows us to structure events in Δt_{length}.
- $\Delta t_{density}$, the fractal dimension of time, is the temporal density of a time series.

It is important to realize that Δt_{depth} logically precedes Δt_{length}: There is no Δt_{length} without Δt_{depth}, i.e. no succession is conceivable without a presupposed embedding simultaneity.

4.1 Fractal and Non-Fractal Observers

There are two types of observer: fractal and non-fractal [Vrobel, 1997, 1999]. A non-fractal observer has no nesting faculties and can therefore not generate the embedding level of description which would allow him to hear a tune. This observer type can perceive only isolated notes in a tune or isolated events in a time series. As he would not be able to generate a temporal fractal perspective through continuous nestings, simultaneity, succession and memory formation would be unknown to him. Thus, no learning or reflection could take place. The non-fractal observer would live in an eternal succession of unconnected Nows. He would not be able to perceive an auditory or visual illusion, as he could not contextualize inputs.

A fractal observer, on the other hand, is able to hear a tune, as he can observe events on a number of LODs. This enables him to generate a nesting cascade of LODs, a temporal fractal perspective, which allows him to observe succession and simultaneity of events directly, in real time [Vrobel, 2000]. This observer may also be a smart detector with anticipatory faculties [Vrobel, 2002, 2005b]. A temporal fractal structure which appears to be a highly complex time series (when measured with conventional methods) would appear as not very complex to an observer with a temporal fractal interface containing the same internal structure (number of nestings (LODs) and scaling factors) [Vrobel, 2005a]. He would not be able to spot visual and temporal illusions, as he could not evade contextualization.

5 Observer-Frame Complexity and Interface Complexity

Two measures of complexity which differentiate between what belongs to the observer and what belongs to the rest of the world are conceivable: The first, observer-frame complexity, measures the internal differentiation of the observer in terms of Δt_{depth}. Such a differentiation, which shapes the structure of the observer's interface, may be revealed by registering internal correction processes, e.g. the perception of auditory illusions by an observer (listener). It may be measured in the number of (simultaneous) LODs. The second, interface complexity (IC), measures the number of simultaneous *de-nesting performances* carried out by the observer (and thus defines the degree of complexity reduction).

$$IC = \frac{\text{Number of nested LODs (observer)}}{\text{Number of nested LODs (world)}}$$

To conclude, complexity is a relative, LOD-dependent measure. The measure of IC will decrease with the number of LODs available to the observer and increase if there is little or no one-to-one mapping between the observer's internal structure and the structure of the embedding outside world [Vrobel, 2005c].

Contextualization through nesting LODs as well as the matching of LODs on the observer-world interface presented in this paper are reminiscent of Irina Ezhkova's notion of *tuning into contexts* [Ezhkova 2004]. Although a general notion of relativity is inherent in the relative measure of IC, the present approach is not based on Ezhkova's principles of relativity, rationality and clarity. The concepts described here, which are derived from cognitive examples and epistemological considerations, focus only on the notion of relativity. Basic notions such as time, the Now, succession and simultaneity are described in the framework of my Theory of Fractal Time. It is conceivable, however, to regard the fractal interfacial structure presented in this paper as the result of Ezhkova's zooming (adjusting) webs of knowledge (networks) to differing degrees of granularity and sensitivity [cf. Ezhkova, 2004].

6 Possible applications

In meditation, techniques based on nesting and de-nesting exercises may help to synchronize inside and outside simultaneity. Visual and auditory illusions may be disentangled by focussing on the part and the whole – the nested and the embedding structures [Van Nieuwenhuijze et al, 2006].

In the wake of this nesting and de-nesting approach, a new therapeutic tool for medical disorders may result. Individuals suffering from depression will most probably profit from de-nesting exercises (as they cannot appreciate any impressions as new as a result of their strong intentionalism), whereas someone suffering from schizophrenia (who finds himself unable to embed his private logical frame of reference to the outside world) would benefit from nesting exercises. These nesting exercises would involve contextualization by creating a common reference frame with the embedding surroundings (including therapists and other "normal" individuals). Dieter deGrave suggested seeing the complex structure of schizophrenia not as a disorder *per se* but a psychosocial structure in its own right:

"When dealing with schizophrenia, we should always remember that we are talking about people in interaction with their environment, trying to make the best of things. (...) They are busy trying to piece together the missing parts, the things other people tell them are out of order, unhinged, unbecoming in that place, at that time. To the outside world it seems as if time and logic have collapsed into nonsense, to them all forms of understanding have imploded into the magnificent insight which makes up their [the schizophrenics'] delusion. (...) It is not that their delusions are wrong *per se*, the fact is that they could be wrong, just like any other thought anybody might have. In this we are all equal and in this we can find a middle ground between 'normality' and schizophrenia." [deGrave, 2005]

I do not claim that therapeutic approaches which take into account temporal fractal perspectives alone may lead to an improvement. This paper focusses only on one aspect (namely context-dependence). But the idea of creating shared logical reference systems seems to be a promising approach.

It may therefore be worth considering whether mental and physical disorders may be grouped into conditions of *interfacial misfits*, i.e. congruence or non-congruence with inside and outside simultaneity [Vrobel, 2005f]. A study which includes control group subjects could show whether or not such groupings into categories of *interfacial misfits* prove useful.

The notion of an *interfacial misfit* may also be applied in risk analysis. Here, subjective and objective estimates of risk generally vary greatly [Llewellyn, 2005]. This discrepancy may also be interpreted as a mismatch when simultaneity on the inside (subjective estimate) and simultaneity on the outside (objective estimate) are not in a one-to-one mapping. It is conceivable that a deeper understanding of the nesting performances carried out by individuals when they use context could help anticipate their risk-taking behaviour.

Another possible field of application of the *interfacial misfit* model is custom-made encryption. De-nesting of a multi-layered, embedded input, i.e. identification of context, splits a perception into signal and noise [Vrobel, 2005e].

The increase in nested LODs on the observer's interface increases the complexity of his brain. The newly formed LODs can be permanent, i.e. the observer cannot change his interpretation in a future exposure to the same stimulus.

Figure 3 [Ramachandran et al, 1999]

Ramachandran et al show that once you have seen the dalmatian dog in this picture (Figure 3), it is impossible not to see it again if you re-see the picture. The initial exposure has set the course for all future interpretations. [Ramachandran et al, 1999]

Ramachandran et al also showed that, on the neural level, neurons in the temporal lobes become altered permanently after initial brief exposure. [Tovee et al, 1996]

This could be used for a conditioning of observers to interpret a hidden signal always in the same predictable way. It may therefore be used as a custom-made coding and decoding mechanism. This encryption would be made-to-measure for one observer brain (or, if desired, for pre-defined observer types).

The amount of nested contexts an observer recognizes and thus makes use of may be modified by means of training nesting and de-nesting exercises. Such trained observer types or individual observers will – after initial exposure - always reinterpret a perception in the same way regarding a recognized structure and its embedding context – and are thus able to distinguish signal from noise [Vrobel 2005e].

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