The Many Aspects of Anticipation

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Contents

1. Anticipation as a Shift of Paradigm?

The mainstream wisdom claims that causes move things forward. As solid and reassuring as this statement may be, it nevertheless runs into trouble as soon as phenomena of self-organization or network causality are taken into account. What kinds of causality are they? Matters become even worse when the emergence of hierarchies – i.e. levels of organization – are considered. Even if hierarchies may emerge from the bottom up, the higher levels usually exert some kind of top-down constraining influence on the lower levels of the hierarchy. To say the least, downward causation is far from being part of the received wisdom. The hierarchical loops emerging from the cycles of up and down causations between hierarchical levels are even farther away from the mainstream. When hierarchies further assume the form of different, possibly tangled, levels of reality between different types of entities – atoms, molecules, organisms, minds and societies – it is obvious that something important has been missed by mainstream theories of causation ((Poli, The Basic Problem of the Theory of Levels of Reality, 2001), (Poli, Three Obstructions: Forms of Causation, Chronotopoids, and Levels of Reality, 2007)).

In this paper I shall discuss anticipation, which possibly the most important aspect missing from mainstream theories of causation. Behaving in an anticipatory way means adjusting present behavior in order to address future problems. In other words, an anticipatory entity (system or whatever) takes its decisions in the present according to forecasts about something that may eventually happen.

The best-known definition of anticipation is Rosen's: "An anticipatory system is a system containing a predictive model of itself and/or its environment, which allows it to change state at an instant in accord with the model's predictions pertaining to a later instant" (Rosen, Anticipatory Systems. Philosophical, Mathematical and Methodological Foundations, 1985, p. 341).

The most obvious mistake committed by almost everyone when first confronted with the idea of anticipation is to think that anticipation is a feature that *we* possess because we are such highly complex and wonderfully sophisticated cognitive agents. This is not what the theory of anticipation claims. Indeed, the major surprise embedded in the theory of anticipation is that anticipation is a widespread phenomenon present in and characterizing all types of realities. Life in all its varieties is anticipatory, the brain works in an anticipatory way, the mind is obviously anticipatory, society and its structures are anticipatory, even non-living or non-biological systems can be anticipatory. All this comes as more than a surprise.

If all this is true, and providing that the necessary supporting evidence can be accumulated, it implies that a proper understanding of anticipation requires the adoption of an innovative conceptual framework. Moreover, this new framework will have to be innovative in many different ways, some of which will be mentioned by this paper.

2. A Minimal Overview of Theories of Anticipation

As soon as one starts collecting data on anticipation, the first unexpected surprise is the finding that over the past century many scholars from many different disciplines and fields have worked on anticipation. The unwelcome result is that nobody has to date collected and compared the various proposals. It may well be that the same phenomenon has been discovered times and again. Even so, it would be interesting to know the differences, if any, among the theories. It may be that different scholars have seen different aspects of anticipation, and a thoroughgoing comparison between them may help develop a more rounded-out theory. The following notes are nothing more than a preliminary and still rather idiosyncratic survey. Much more systematic work must be done.

2.1 Philosophy

The two main sources are (Husserl, 1991) and (Bloch, 1995). Husserl sees anticipation as one of the three components of the most basic structure of consciousness: the specious present. For Husserl, what is actually given is always surrounded by a double halo comprising what has just happened (retention: strictly speaking, something has gone but its effects are still active) and what is going to happen (pretension or anticipation: even if we do not know what is going to happen, we naturally – i.e. automatically – develop expectations, which may eventually be confirmed or disconfirmed). Since Husserl, numerous other thinkers more or less closely related to phenomenology have elaborated other aspects of anticipation (Stein: empathy as an anticipatory behavior, Schutz: anticipation in the social world (see 2.6 below), Scheler and Hartmann on the connections between anticipation and ethics).

However, the thinker who has conducted the most extensive categorical analyses of the future has undoubtedly been Ernst Bloch. His *The Principle of Hope* (Bloch, 1995) resembles an encyclopedia of the categories of the future. The future as an ontological category makes sense only if entities are categorically open, i.e. they are only partially determined, some of their aspects are still hidden or latent.

The difference between being hidden and being latent can be clarified as follows: hidden components are *there*, waiting for triggers to activate them. On the other hand, latent components do not exist at all in the entity's actual state. Latent components relate to incompletely present conditions and aspects. Their incompleteness may be ascribed either to still maturing conditions or to new conditions that may subsequently arise ((Poli, The Ontology of What is Not There, 2006) (Poli, The Complexity of Anticipation, 2009)).

2.2 Physics

Dubois has developed an original version of anticipation able to comprise physical phenomena. See (Dubois, 2000). More recently, Ferret has viewed anticipation as stored in the structure of a system's potential energy (this volume).

2.3 Biology

The fields in which anticipation has been most extensively studied are biology, brain studies and psychology. As to biology, anticipation has been studied in different ways, namely as the actual behavior of specific types of organisms and as a step towards understanding life itself.

Over the past few decades, an enormous amount of experimental evidence in favor of anticipation as a behavioral feature has been accumulated. The hunting habits of snakes and dogs are as good a starting point as any. Snakes search for a prey where it was last sensed. On the other hand, dogs hunting a prey do not need to sense it continuously: dogs are able to anticipate where their prey will be (Sjölander, 1995).

Studies on anticipation in animals have moved through two main phases of development (Hoffmann, 2003). The first phase was centered on Tolman's "expectancies" ((Tolman, Purposive Behavior in Animals and Men, 1932) (Tolman, There is More Than One Kind of Learning, 1949)). One of Tolman's major findings was the discovery of *latent learning* in rats, i.e. learning of environmental structures despite the absence of reinforcement. The studies conducted by Tolman had little impact, however, and the study of anticipatory behavior in animals started to spread only in the 1980s (see (Hoffmann, 2003) for extensive references).

A couple of very recent studies are worth mentioning. It has been shown that scrub-jays are able to make provision for future needs. As a recent report in *Nature* states: "the results described here suggest that the jays can spontaneously plan for tomorrow without reference to their current motivational state, thereby challenging the idea that this is a uniquely human ability" (Raby, Alexis, Dickinson, & Clayton, 2007, p. 919). Animals do not save food alone: apes, for instance, save tools for future use (Mulcahy & Call, 2006).

As soon as one stops thinking that animals are machines, all this should be less unexpected. Indeed, given that anticipatory behavior dramatically enhances the chances of survival, evolution itself may have found how to give anticipatory capacities to organisms, or to at least some of them. The real issue is not whether living systems are anticipatory systems, but which systemic features make anticipation possible.

This question leads immediately to Robert Rosen and his theories. Rosen's problem was "what is life?" (see Louie's tutorials, this volume; for two recent summaries of aspects' of Rosen's work see the collections (Baianu, 2006) and (Mikulecky, 2007)). Rosen found anticipation while trying to spell out the features of life in detail. A remarkable aspect of his theory is that it was able to show – even to prove – that anticipation does not need to be limited to living systems. I shall return to this point below.

2.4 Brain Studies

Among the leading scientists in the brain studies field, Alain Berthoz is possibly the one who has most stressed the anticipatory nature of the workings of the brain. The main aspect is that when the brain must take a decision, it does not have sufficient time to traverse the state space of all the possible choices. To decide efficiently, the brain must decide which options are more likely to become real, i.e. it has to anticipate. Apparently, neurons and more complex brain structures contain what have been called "internal models", whose main task is to guide the system in its decision-making activities (be these the firing of neurons or something more complex for higher-order structures). Furthermore, there is a growing body of evidence that the working of the brain is not limited to neuronal activity. Volume and glial processing have also been recognized, and they are apparently closely linked with Rosen's expectations (for details, see (Kercel, 2004)).

2.5 Psychology

Anticipation is an old friend of psychologists. Herbart claimed that anticipations of sensory effects not only precede but also determine voluntary movements. This thesis, known as the Ideo-Motor Principle (IMP), runs contrary to the claim that psychic processes in general are determined by stimuli (i.e. it is at odds with both behaviorism and most of current cognitive psychology). For an overview of IMP see (Stock & Stock, 2004).

After the prelude represented by Herbart, studies on anticipation in psychology have been conducted only very recently, providing evidence of distinct forms of anticipation in learning, attention, object recognition, and many other cognitive activities (see (Hoffmann, 2003) for references).

These studies show that behavior is more goal oriented than stimulus driven. In other words, they show that there are robust reasons for challenging one of the main assumptions of cognitive science, namely that stimuli come first. The contemporary version of IMP claims instead that ambient interactions reinforce *anticipated* outcomes.

Behavioral and cognitive schemata – be they pre-given or acquired – shape the way in which organisms look at the environment. For this reason they are anticipatory: “Schemata construct anticipations of what to expect, and thus enable the organism to actually perceive the expected information” (Riegler, 2003, p. 13).

2.6 Social Sciences

Alfred Schutz developed and applied phenomenology to the social sciences. He argued that we simultaneously live in different contexts of meaning, with different temporal dimensions, at different levels of familiarity. Schutz distinguished three main systems: thematic, interpretative and motivational. The system of most interest here is the last one, the motivational system.

According to how motivational systems operate, actions are typically framed by two types of opposition: the opposition between my actions and your actions and the opposition between future and past actions. Future actions are interpreted according to an “in-order-to” structure, whilst past actions are interpreted according to a “because” structure. In-order-to motives are components of the action: they shape the action from within. By contrast, because-motives require reflective acts upon already taken decisions. This structure helps explain why we perceive actions as free according to in-order-to-motives and as determined according to because-motives.

Actions are always elements of wider projects, which in their turn rely on various stocks of knowledge. One of the most familiar components of knowledge is the stock of typical expectations, which may become actual in typical circumstances and predetermine typical reactions. As Riegler notes, “Instead of getting overwhelmed by the details of a new situation, humans seek to replace them with familiar activity and behavioral patterns that show a high degree of predictability to putatively gain control again, to be able to anticipate the outcome” (Riegler, 2003, p. 12). In this sense, indeed, new experiences may be familiar as to their type.

Following the algorithmic interpretation developed by (Dubois, 2000), Leyesdorff has applied the idea of anticipation to social systems in a number of papers (see (Leydesdorff, 2008) and references therein).

This may be the appropriate place to note that “during the past thirty years substantial experimental data have shown that all axioms of expected utility theory have been violated by real subjects in experimentally controlled situations” (Berthoz, 2003). Real agents are far from being ideal or idealized decision makers, as expected utility theory assumes. On the contrary, we systematically make mistakes, for various reasons including social pressure, the tendency to agree with others, the influence exerted by hierarchical structures, the role of emotions, the desire to be right, the way in which problems are represented (Berthoz, 2003). All this may eventually provide robust evidence that it is time to update decision making programs as used in business schools for managers, public policy schools for administrators, or military schools for soldiers

2.7 Semiotics

The most convinced proponent of anticipation in semiotics and cultural studies is Nihail Nadin; see his (Nadin, 2004). Interested readers may find some of his film clips on anticipation on YouTube.

2.8 Engineering

Engineers have realized that feed-back controls are too limited. They can reestablish a system's working conditions after a perturbation, but this takes time; and in many real applications there may not be enough time for this to come about. For this and other reasons, a new class of controllers has been developed, namely feed-forward controllers ((Camacho & Bordous, 1998), (Negenborn, Schutter, & Hellendova, 2004)). I shall return to controllers in section 5.1 below.

2.9 Artificial Intelligence

Anticipatory research in artificial intelligence is gaining momentum ((Butz, Sigaud, & Gérard, 2003) , (Butz, Sigaud, & Baldassarre, Anticipatory Behavior in Adaptive Learning Systems: From Brain to Individual an Social Behavior, 2007)). The objective is to develop applications with embedded anticipatory *mechanisms*. Mandatory for artificial intelligence applications are mechanical or algorithmic procedures, and these entail developing a type of anticipation that is very different from the anticipation characterizing organisms. Some of the main differences will be soon presented. To date, anticipatory artifacts have been developed for application in cases of reinforcement learning, artificial classifier systems, neural networks, and many more.

2.10 Futures Studies

Anticipation in futures studies is too well known to the readers of this journal for any summary to be necessary. Studies of futures fall under many headings, and they employ a huge variety of techniques, ranging from forecasting to simulation, from planning to trend extrapolation to scenarios. Highly diverse conceptualisations and formalisations have been proposed as well. This remarkable variety can be simplified to some extent by stating the main assumptions underlying them. Two such main assumptions are that (1) the future is at least partly governed by the past, and (2) the future can be better confronted by opening our minds and learning to consider different viewpoints.

According to (1) the future is part of a structured story whose past and present are at least partially known. The claim here is that the forces which have shaped past and present situations will still be valid as the situation under consideration unfolds. The core thesis is that the future is embedded in the past; it is the projection of the past through the present. Time series analysis, trend extrapolation, and forecasting pertain to this family of studies. Any of the mentioned methodologies may be further supplemented by computer-based simulations.

Rather than directly addressing the problem of searching for the seeds of the future in the past, (2) considers the different problem of preparing for the unforeseeable novelties awaiting us in the future. Learning about widely different outcomes is the issue in this case: one must be ready to consider and address possibly unfamiliar or alien scenarios. The main outcome of this exercise is a greater capacity to distinguish among possible, probable, and preferred future scenarios. These activities fall under the heading of future studies, whilst scenario construction is the best-known methodology adopted by practitioners.

3.The Phenomenon of Anticipation vs. the Case of Anticipatory Systems

After the rapid overview conducted in the previous section, it is now time to delve deeper into the nature of anticipation. I shall start by distinguishing the capacity of anticipation from the nature of systems able to exhibit anticipatory behavior (i.e., anticipatory systems). I contend that studying anticipation as a capacity is very different from studying anticipatory systems. The former endeavor adopts a descriptive attitude, conducts experiments and collects data, whilst the latter seeks to understand what it is that makes anticipation possible.

Clear understanding of the difference between anticipation as a property that some class of systems exhibits, on the one hand, from the internal structure that a system should possess so that it can behave in an anticipatory fashion, on the other, requires anticipation to be distinguished from its external modeling or eventual simulation. The difference between internal and external modeling is relevant here. External models seek to capture the outcome of a specific system. Given a system S characterized by behavior B, the system's model tries to find an algorithm producing values as close as possible to behavior B. External models are only interested in the equivalence between their output and the system's behavior; they do not address the problem of how the system actually produces its own behavior. Internal models, on the contrary, do consider the internal working of the system. An internal model endeavors to capture the system itself, or better its internal determinants. We shall see that anticipatory systems are self-referential or impredicative systems. They are therefore such that no algorithm can ever model their behavior.

Two remarks are in order: (1) the fact that no algorithm is impredicative does not entail that we must give up formal modeling; the theory of rote formal machinery is but one part of contemporary mathematics: however important it may be, it is still only a part; (2) although it is impossible to completely model an impredicative system within an algorithmic framework, this does not rule out the possibility of "freezing" the system and of modeling the specific configuration and behavior of the "frozen" system. One can also break the system's evolution down into a number of main steps, model them, and ask which properties a transition functor should have in order to model the system's passage from phase n to phase n+1 (two recent studies have started to work out the relevant details: the idea of variable topology by (Brown, Glazebrook, & Baianu, 2007), and memory evolutive systems by (Ehresmann & Vanbremeersch, 2007)).

4. The Phenomenon of Anticipation

Anticipation comes in many different guises. The simplest distinction is between explicit and implicit anticipation. Explicit anticipations are those of which the system is aware. They may be used as synonyms for predictions or expectations. Implicit anticipations, by contrast, work below the threshold of consciousness. They may be active within the system without the system itself being aware of them. Implicit anticipations are properties of the system, intrinsic to its functioning.

As far as explicit anticipation is concerned, the reflexive side of explicit anticipation becomes visible as the difference between looking into the future and taking account of the consequences of that looking, i.e. as the impact of an anticipation on current behavior. The types or aspects of behavior that can be modified through anticipation are exemplifications of normative behavior. If the system evaluates its own evolution as positive (according to its own criteria), it will maintain its behavioral patterns; conversely, if the system evaluates its own evolution as negative, it may seek to change its behavioral patterns in order to prevent the occurrence of the anticipated negative results.

From an evolutionary point of view, explicit anticipation is an advantage because it enables more rapid goal-directed processing. The other side of the coin, however, is that focused goal-oriented behavior usually gives rise to inattentional blindness. Patterns constrain attention, govern the boundary of relevance, and they direct attention to pre-established foci. The more efficient the patterns, the more likely is the outcome of an over-restricted focus of attention. The more efficient the behavioural patterns are, the more rigid they become.

Anticipation exhibits a variety of temporal patterns, from microanticipations embedded in perception to usually longer forms of social anticipation, ranging from seconds to years and decades.

A major question is whether explicit anticipations depend – or to what extent they may depend – on implicit ones. As (Riegler, 2003, p. 11) aptly asks: " "Are we consciously creating anticipations on basis of which we plan and make decisions, or are anticipations and decisions making made for us?" Finding the correct answer to this question is far from being a trivial undertaking. The apparently obvious answer that explicit anticipation depends – at least to some extent – on implicit anticipation may beg the question. For it may well turn out that the two forms of anticipation are based either on entirely different enabling conditions, or on different subsystems, or even on entirely different systems. This last case makes sense as soon as one envisages a system composed of different systems (as opposed to the more conventional idea of a system composed of functional subsystems).

None of the best-known theories has yet explicitly addressed the problem that systemic behaviour may be the result of processes unfolding at different levels of reality, including the biological level (perception, brain processes), the psychological level (cognitive processes), and the social level (social interactions) (for the theory of levels of reality see (Poli, The Basic Problem of the Theory of Levels of Reality, 2001), (Poli, Levels of Reality and the Psychological Stratum, 2006), (Poli, Three Obstructions: Forms of Causation, Chronotopoids, and Levels of Reality, 2007)).

None of the above mentioned questions can be answered without moving from anticipation as a detectable behavior to anticipatory systems.

5. Anticipatory Systems

With the remarkable exception of Rosen's work, the great majority of the studies conducted to date address the problem of anticipation within some specific field of inquiry. Only rarely have scholars discussed the problem of the features which a system should possess so that it can behave in an anticipatory fashion.

Analysis of the enabling features of anticipation can be conducted at two different levels: firstly by considering the set of controllers a system may possess, secondly by asking what abstract features a system must possess in order to be an anticipatory system.

5.1 Controllers

On considering the problem of the regulatory structure that a system may have, Rosen distinguished five different types of controller. In order of complexity, the five cases are the following:

1. System with feedback controllers.
2. System with feed-forward controllers.
3. System with feedback controllers with memory.
4. System with feedforward controllers with memory.
5. System with general purpose controllers.

Feedback controllers "perceive" the system's environment. The most important characteristic of feedback controllers is that they are special purpose systems: for them only highly selected aspects of the environment are relevant. Feedback controllers steer the system in order to force it to maintain some selected value. This is achieved by error signals indicating the difference between some fixed value and the actual value of the selected environmental variable. Within limits, the controllers of this family neutralize environmental variations and are able to keep the system stable. Their main limitation is the delay between environmental change and system adjustment: if the changes in the environment happen too rapidly (the exact meaning of "too rapidly" depends on the type and sensitivity of the controller) the controller ends up by tracking fluctuations and rapidly loses its capacity to steer the system.

Unlike feedback controllers, feedforward ones "perceive" the controlled system, not the environment. The simplest way to imagine a feedforward controller is to think of a model of the system. In other words, a material system with a feedforward controller is a system containing a material model of itself. In order to behave as a feedforward controller, the model must run at a velocity faster than the velocity of the system. In this way the model anticipates the system's possible future state.

The third class of controllers comprises feedback controllers with memory. If a feedback controller is able to leave a trace of the system's experience, this memory trace can be used to tune the system's behavior better. A system with this capacity is obviously able to learn from its past experience.

The next class of controllers consists of feedforward controllers with memory. As in the previous case, systems of this type can learn from their past experience. Rosen notes that systems of this type – "ironically", he says – must use feedback controllers of type 1 for their operations. In fact, they must be able to work on deviations from predicted states (i.e., they need error signals, exactly like type 1 controllers).

The last type consists of systems with general purpose controllers. All the controllers discussed so far can be described as working on single types of "perceptions" or variables. The obvious next step is to let systems behave in as articulated a way as possible (i.e., exploit as many variables as possible). The only constraints are the unavoidable need to use feedback controllers to modify the internal models of systems with type 5 controllers.

5.2 Abstract Anticipation

The simplest form of anticipation requires type 2 controllers, i.e. controllers that monitor the system. In other words, an anticipatory system is a self-observing system, a self-referential system. The guiding idea is that an anticipatory system is organized in such a way that at least some of its functions form a hierarchical loop: the selected functions are mutually linked one to another. According to Rosen, the complexity of life is such that all the system's functions are mutually implied by each other ((Rosen, Anticipatory Systems. Philosophical, Mathematical and Methodological Foundations, 1985), (Rosen, Life Itself, 1991), (Rosen, Essays on Life Itself, 2000)). The complexity of anticipation is simpler than the complexity of life because it only requires that at least *some* functions be mutually implied ((Poli, The Complexity of Anticipation, 2009), (Louie, Functional Entailment and Immanent Causation in Relational Biology, 2008), (Louie & Kercel, Topology and Life Redux: Robert Rosen's Relational Diagrams of Living Systems, 2007)).

Over the past few decades, a number of scholars have found that many different types of system are based on hierarchical loops: two relevant cases are the theory of autopoiesis initially developed by Maturana, and Luhmann's theory of social systems ((Maturana & Varela, Autopoiesis and Cognition, 1980), (Maturana, Autopoiesis, 1981), (Luhmann, Social Systems, 1995), (Luhmann, Die Gesellschaft der Gesellschaft, 2 vols, 1997); for an overview see (Poli, The Complexity of Anticipation, 2009)).

What may not be apparent is that systems containing hierarchical loops present a new kind of complexity, which is now briefly discussed.

6. Higher-order Complexity

Complexity, as usually understood, refers to chaotic systems, i.e. to systems which are deterministic and sensitive to their initial conditions. Thus understood, complex systems are entirely past-governed. For obvious reasons, mainstream complexity is utterly unable to address the challenge raised by anticipatory systems.

The concept of super-complexity has been introduced in order to distinguish anticipatory systems from entirely past-governed ones ((Baianu & Poli, From Simple to Super- and Ultra-Complex Systems: A Paradigm Shift Towards Non-Abelian Emergent System Dynamics, 2009), (Poli, The Complexity of Anticipation, 2009)).

The rather technical distinction among simple, complex and super complex systems can be approached by considering the possibly simpler distinction among different types of wholes.

- **Decomposable wholes (simple and chaotic systems).** The system can be fragmented into constituent parts without losing relevant information. This implies that the system can be reconstructed from its parts. Similarly, the dynamics of the system can be reconstructed from the dynamics of its parts. Mechanisms are cases in point. Analytic, algorithmic methods work well with wholes of this type.
- **Quasi-decomposable wholes (complex systems)**. Fragmentation into constituent parts loses information, irreversibly. Individual cases can still be modeled, even if in an ad-hoc way (the most famous case being represented by the three-body problem). Universal analytic methods are not available for these cases. It is in this that most engineering knowledge consists.
- **Indecomposable wholes (super complex systems)**. These wholes are irreducible: their fragmentation loses information. Analytic methods fail to work even for individual cases. Since indecomposable wholes are not (entirely) understandable from their parts, the manipulation of parts may produce unexpected consequences.

Anticipatory systems are indecomposable wholes in the sense specified. They are indecomposable because of the hierarchical loop(s) that they contain. The difference may eventually be assumed between properly super-complex systems, some of whose functions are mutually implied, and hyper-complex systems, all of whose functions are mutually implied (as for organisms). One may then claim that super- and hyper-complex systems are the two cases of higher-order complexity theory.

7. Conclusion

Even if most of the details concerning anticipation and anticipatory systems are still unknown, the following partial observations summarize the current state of knowledge.

- Anticipation comes in different guises, such as explicit as opposed to implicit anticipation. Furthermore, different types of anticipation may be at work contemporaneously, such as biological, psychological and social types of anticipation. They have their own temporal patterns, and may be distinguished by other properties as well. Moreover, when different types of anticipation are simultaneously active, they may work harmoniously together or they may interfere with each other.
- Anticipation has been a major evolutionary discovery. If Rosen is correct, anticipation does not necessarily depend on previous memories. This amounts to saying that anticipation lies deeper than memory in the functional structure of organisms. It apparently also applies to both psychological and social systems. This is an important contention which requires firmer supporting evidence.
- The abstract structure of anticipation depends on hierarchical loops, also known as self-referential, or impredicative loops. This imposes very severe constraints on the modeling of anticipation systems, because, almost by definition, mechanical or algorithmic procedures cannot be self-referential.

Anticipation and anticipatory systems are one of the challenges that science is starting to address. At this stage of development, it is simply impossible to know where anticipation will take us. What anticipation shows, however, is that reality has still many surprises in store.

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