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Essay

Special Relativity Theory Expands the Futures Cone's Conceptualisation of the Futures and The Pasts

Epaminondas Christophilopoulos[1,*]

[1]*Head, UNESCO Chair on Futures Research, FORTH/PRAXI, Morichovou sq., 546 25, Thessaloniki, Greece*

The aim of this article is to investigate whether it is possible to expand the way the future cone is used in futures studies, especially in considering various alternative developments of the future and the interconnections between different futures, different pasts and the present.

In physics, researchers focus a lot on studying objects, bigger[1] or smaller[2], as well as the movement of these objects, and the events that these objects are involved in. They calculate the development of these events, they study complex systems, and sometimes they also do some forecasts for the future. Nevertheless, in physics, as in futures studies, researchers also accept and embrace uncertainty, as for example uncertainty is beautifully embraced by Heisenberg, Schrödinger, and other physicists. Heisenberg's uncertainty principle states that it is never possible to know at the same time the exact position and the speed of an object (Wiseman, 2012). In another example, according to the Schrödinger's cat paradox, a hypothetical cat in a box should be equally considered both dead or alive at the same time until the box is opened (Kramer, 2013).

Similarly, in futures studies researchers study systems and utilize a plethora of tools for investigating the mid- or longer-term future. Like physics, futures studies are also intrinsically embracing uncertainty as it is emphatically underlined by Amara's three laws of futures (Amara, 1981): (1) the future is not predetermined, (2) the future is not predictable, and (3) the future outcomes can be influenced by our choices in the present.

The article is attempting to "connect" the two disciplines by focusing on how Albert Einstein's Special Relativity theory and its geometry, the Minkowskian geometry of spacetime[3] (Dray, 2012), is related to the concept of the futures cone, widely used in futures studies. Especially, the focus is drawn upon how one could expand the conceptualization of the futures cone.

First, the concept of the Futures cone and some of its main versions are briefly described. Then, the paper describes the Minkowski space and its light cone, while at the end there is a discussion on some of the obvious analogies between the two concepts and also some ideas for expanding the way the futures cone is utilised in future studies.

Futures Studies: The Futures Cone

Futurists have been speaking over the years of *three* main classes of futures: possible, probable, and preferable (Fig. 1). This first public reference to the "cone of plausibility" was by Charles Taylor in 1990 to illustrate the geopolitical scenarios he posed in *Alternative World Scenarios for Strategic Planning* (Taylor, 1990). Since Taylor's initial development of the "cone of plausibility," many simplified and modern alternatives have been developed by futurists including Trevor Hancock, Clement Bezold and Joseph Voros who created a super extended version of the cone in 2003, consisting of 7 alternative futures (Voros, 2017).

* *Corresponding author*.
E-mail addresses: epaminondas@praxinetwork.gr (E. Christophilopoulos). www.futures.gr

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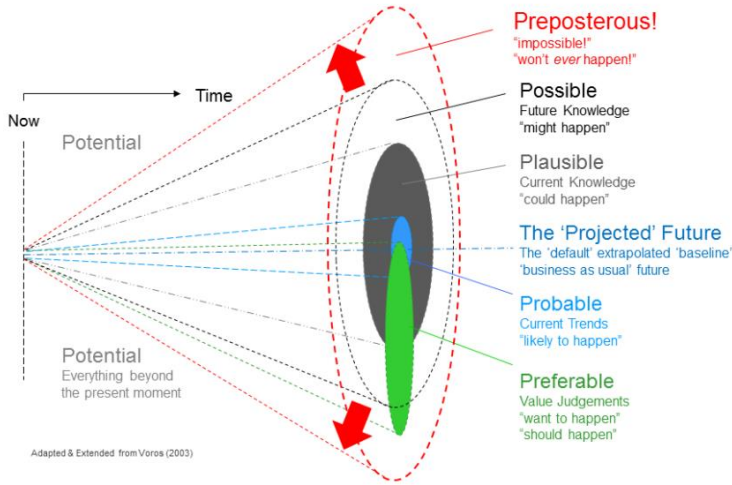

Fig. 1: The expanded futures cone by Voros (2017)

The main characteristics of the Voros futures cone are briefly explained below (Voros, 2017):

- Potential – everything beyond the present moment is a potential future. This comes from the assumption that the future is undetermined and 'open' not inevitable or 'fixed'.
- Preposterous –the futures we judge to be 'ridiculous', 'impossible', or that will 'never' happen.
- Possible –the futures we think 'might' happen, based on some future knowledge we do not yet possess, but which we might possess someday.
- Plausible –the futures we think 'could' happen based on our current understanding of how the world works (physical laws, social processes, etc).
- Probable – the futures we think are 'likely to' happen, usually based on current trends.
- Preferable – the futures we think 'should' or 'ought to' happen.
- Projected – the (singular) default, *business as usual*, 'baseline', extrapolated 'continuation of the past through the present' future.
- (Predicted) – *the* future that someone claims '*will*' happen.

Voros has managed to expand the initial Futures Cone concept mainly with some additional subdivisions of the future. This version of the futures cone, could also be imagined as a set of Matryoshka dolls (Fig. 2), where all different parts (classes) of the future are contained in the Preposterous Future doll. However, this alternative visualization, the Matryoshka paradigm, demonstrates that although, our view of the future is expanded, the futures are still described in a restrictive way.

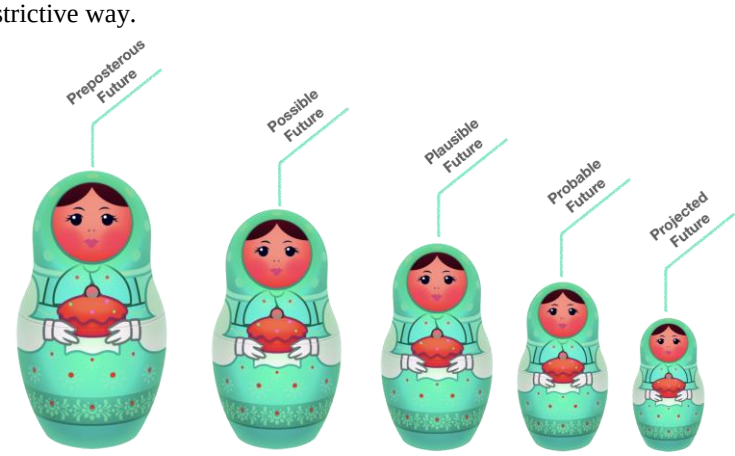

Fig. 2: Matryoshka dolls (Source: Author)

It should be indeed admitted that the futures cone serves us well for the vast majority of the cases studying the future, the same way Newtonian physics serve us well in a wide range of simple systems. Nevertheless, using the futures cones as an aid to imagine the future, some conceptual questions might arise:

- Who is the observer standing at the apex of the cone?
- Does the futures cone represent the global futures or only the subjective futures related to a specific observer?
- Is there something anything outside the cone? Voros has expanded the traditional futures cone adding preposterous futures and describing them as the part of the cone including all the "impossible" futures. So, is there anything even outside this "borderline"?

In addition, the current description of the futures cone does not explain the interconnection of the various "events" inside the cone: are these "events" inside the cone somehow connected and especially could one influence these events? Furthermore, the futures cone does not provide any info of the past (while the past is taken into in futures studies) and how the past is connected with the present moment. Finally, a question may appear: Is the past plural like the future?

Physics: The Special Relativity Theory and The Minkowski Spacetime

Now imagine that you were a "physicist" at the beginning of the 20th century, where everything was monopolized by Newtonian theories developed in the 18th century.

In 1905, Albert Einstein published the theory of special relativity that explains how to interpret motion between places that are moving at constant speeds relative to each other (Zimmerman Jones & Robbins, n.d.). Nevertheless, Einstein's theory was initially ridiculed as impractical and absurd by the global scientific community of the time, especially as the new theory questioned the widely accepted, mainly British, physics (Wills, 2016).

Einstein's theory of special relativity created a fundamental link between space and time. Since then, the universe can be viewed as having 4 dimensions (three space and one-time dimension), and that changed forever how everybody looks and experiences the physical world (and why not the future?).

In 1907, Hermann Minkowski, building upon the special relativity theory, explored a way to visualize the relation between space and time, that proved quite useful especially for puzzling relativistic effects (Norton, 2015). Here is a visual representation of the human condition according to the special theory of relativity, whose spacetime can always be represented by a Minkowski diagram of the short of a light cone (Fig. 3).

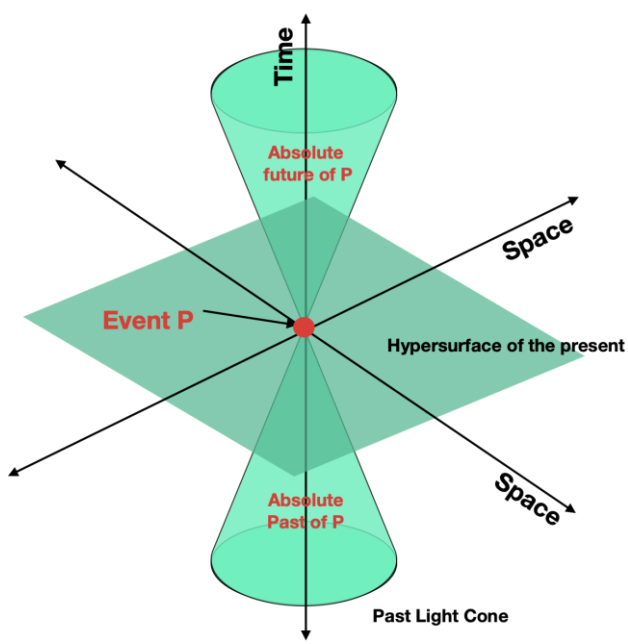

Fig. 3: A subdivision of Minkowski spacetime: the light cone, the absolute future, the absolute past, and elsewhere

The Minkowski spacetime consists of the following main elements[4] (Sard, 1970):

- An event P taking place at a specific moment**.**
- The absolute future of P: Anything here takes place in the future. The event P can theoretically affect all the events that are inside this part of the Light Cone.
- The absolute past of P: Anything here took place in the past. It includes events that directly or indirectly affected the event P.
- The elsewhere space outside the light cone. This area cannot be affected by the event P, and one could assume that belongs to another universe.

In brief, the light cone divides into two halves, called the *future* and *past light cones*. Only events in the past light cone can be a cause for the event at the vertex of the light cone, and the event at the vertex of the light cone can only be a cause for events within the future light cone (Fig. 4).

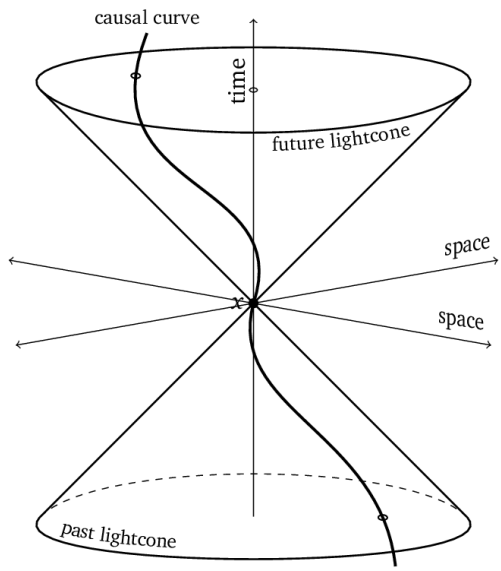

Fig. 4: The Causal Curve (Norton, 2015)

Futures Cone and Light Cone: Expanding Our Futures Understanding

While inspired of the idea to use the special relativity theory for expanding our imagination and "address" the imperfections of the futures cone, a new paper was published using the same idea in order to improve machine learning (Vlontzos , Rocha, Rueckert & Kainz, 2020). It seems that there is indeed something interesting in special relativity theory that could be used by other disciplines.

So, what does the Minkowski space offer to futures studies? How it is possible to further elaborate on the issues raised in the previous sections of this article?

- Who is the observer standing at the apex of the futures cone?
- The futures cone includes the global absolute future or only the subjective future related to the specific observer?
- Is there anything outside the futures cone? Voros (2017) has expanded the traditional futures cone adding preposterous futures and describing them as the part of the cone including all the "impossible" futures. So, is there anything even outside this "borderline"?
- Does the futures cone say anything about the rules of causality?

Well, if the special relativity concepts are applied as described in the Minkowski's light cone, then the Futures Cone could be upgraded and get some additional attributes that could enrich the conceptualization of the futures (and of the pasts) as visualized below (Fig. 5).

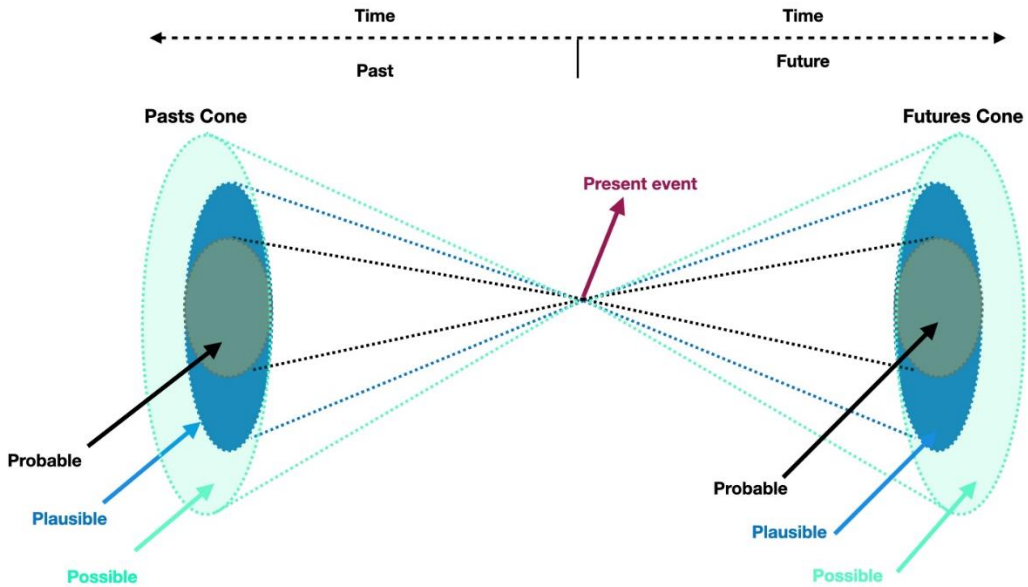

Fig. 5: The Cones of Everything (Source: Author)

Absolute future

It is possible to consider that the tip of the cone represents the present time of a specific event. Thus, one could assume that the cone provides a more "real" representation of the absolute futures. The futures cone doesn't visualize anymore the subjective imagination of an observer. It rather visualizes the fact that the objective future of an event is open to infinite possibilities.

Plurality of the past

The futures cone naturally does not include any representation of the past, however the past is considered in several parts of a foresight exercise. This expanded Cone of Everything includes the past and underlines the plurality of the past. The events in the "absolute" past are those that could have directly or indirectly affected the event on the tip of the cone. As the future is plural, the same applies for the past: different events inside the pasts cone could trigger and create the present event over a casual curve.

Event causality

The Minkowski light cone catalogues what connects with what, demonstrating the causality between events in the cone. If we consider any event "P", the future and past light cone includes all the events in spacetime that are connected with P (Fig. 6). The past light cone contains all the past events that can casually affect P, while the future light cone contains all the events that can be causally affected from P. Thus, the Minkowski light cone manifests that the actions taking place at the present moment affect the future, and practically offers a direct poof for Amara's 3rd law.

The "future" part of The Cones of Everything, is not just representing the absolute future, but actually a future we can affect directly or indirectly - consider the butterfly effect in chaos theory *that* has been embraced by popular culture, and is used to emphasize the outsize significance of minute occurrences (Vernon, 2017).

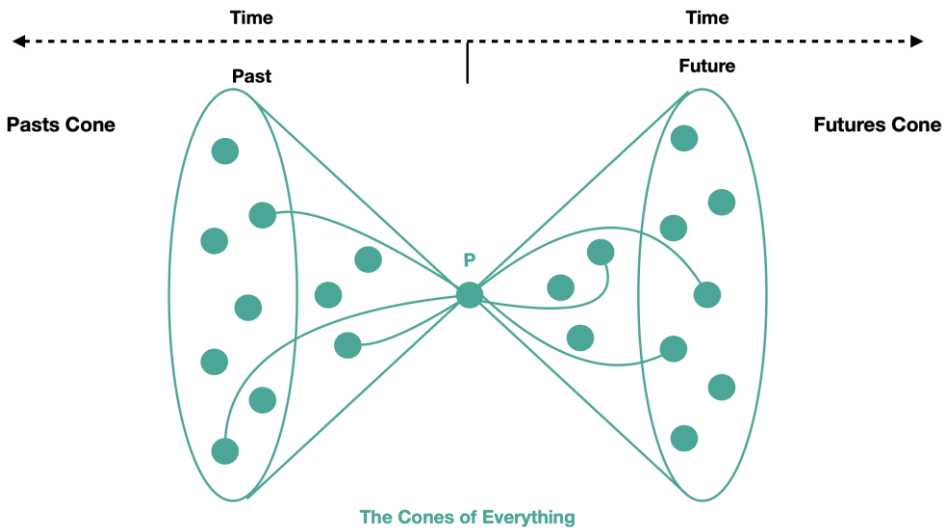

Fig. 6: The Cones of Everything: event causality representation. Source: Vernon (2017)

Totality of the future

The special relativity theory and the Minkowski Spacetime visualization don't divide the future (or the past) in probable/possible/plausible areas. The only limit (by the laws of Physics) is the speed of light. Thus, the surface of the cone in Minkowski spacetime is the absolute limit, while the surface of the cone represents future events that could happen only if we travel with light speed. According to Einstein anything inside the cone has possibilities to occur. Thus, The Cones of Everything could prevent us from thinking of the future in a restrictive way, as depicted above with the Matryoshka dolls example (Fig. 2).

What is outside the futures cone?

In Futures Studies, there is no description of what is actually outside the cone. Voros (2017) describes as "Potential Future" anything beyond the present moment, but the question remains, what is out there? The Minkowski spacetime could provide an answer for this. As it is described above, the spacetime catalogues all the events that are causally affected by the event "P", while anything outside the cone are events that cannot be causally affected by "P", and we cannot actually "see" or "communicate" with these events. This remaining region of the spacetime that is outside both past and future light cones, represents an elsewhere place, like another universe where events could happen and evolve in different ways and create different futures.

Epilog

A theory of everything (TOE) is a hypothetical framework explaining all known physical phenomena in the universe. Researchers have searched for such a model ever since the development of quantum mechanics and Albert Einstein's theory of relativity in the early 20th century (Mann, 2019). Unfortunately, this article does not intend to present a "theory of everything" that combines futures studies and physics, however it is building upon the concepts of the relativity theory in order (1) to expand our mental capacity imaging the futures and (2) to empower by realizing that according to physics, even the smallest action can have an effect on future events.

Notes

1- Such as a train, a car or a spaceship.
2- Such as an electron, photons or neutrinos.
3- As opposed to the usual Euclidean geometry of space.
4- For simplicity reasons, only relevant to this paper elements of the Minkowski spacetime are explained.

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