What Delimits an Event: Systems as the Invariant Elements along Events

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Abstract. *In this paper we propose adopting the notion of system as the invariant element that delimits an event. We argue that it provides cohesion among the succession of situations that characterize an event and renders a clear criterion to decide which objects can be said to participate in an event at each instant.*

Keywords*: ontologies, events, processes, systems, situations, dispositions, connections.*

1. Introduction

In Computer Science, an ontology is usually regarded as an explicit specification of a conceptualization [Gruber, 1993]. That is, it is the specification of a system of categories accounting for a certain view of the world [Guarino, 1998] that describes the set of all possible state of affairs considered admissible in a given domain [Guizzardi, 2005, p.82]. Thus, an ontology can be used to define the meaning of the terms of a language, restricting their possible interpretations in order to allow the language to represent the intended models according to the adopted view of the world, while excluding the unintended ones [Guarino, 1995][Guizzardi, 2005, p.83]. Ontologies may include categories referring to both *continuants*[1], i.e., things that *are* in time, being wholly present at any time point they are present (e.g., a mountain, the particular color of a ball, a contract between two people), as well as *events*[2], i.e., things that *happen* in time, being only partially present at any time point they are present (e.g., a meeting, the falling of a raindrop) [Casati, Varzi, 2015].

In spite of the somewhat widespread view that continuants are ontologically prior to events (i.e., continuants are all that exist and events represent just the distribution of matter and objects in space and time) [Galton, Mizoguchi, 2009], it seems that a great part of our reality is fundamentally dependent on events (e.g., from chemical reactions to business transactions). In practical terms, a good model of events can support several ontology-based reasoning activities, such as pre- and post-condition inference, discovery of temporal relations, inference of missing or implicit events, and identification of incompatible descriptions of a same event [Borgo et al, 2016].

[1] Sometimes referred to as *endurants*.
[2] Sometimes referred to as *perdurants*, *occurrents*, or *processes*.

There are several definitions for the notion of event as well as various aspects to consider when analyzing and modeling this type of entity [Rodrigues, Abel, 2019][Casati, Varzi, 2015]. Even so, we can observe that they follow some major trends. One of them is what we will call the *transition view*, according to which events are described, in some way or another, as transitions between states of the world or, as we will refer in this work, situations [Bunge, 1979][Guizzardi et al, 2013]. For example, the dissolution of a portion of salt in a portion of water would be the transition from a situation with some salt dispersed in the water to another situation in which the salt is dissolved in the water. Besides that, there are certain aspects of the notion of event that are usually considered in ontologies. These aspects include, for example, accounts for the participation of continuants in an event and different ways they can contribute to its occurrence (e.g., agent, product), for temporal partition of events, and for some notion of causation between events [Rodrigues, Abel, 2019].

Current approaches offer rich support to build models of events following the transition view and in terms of the mentioned usual aspects [Rodrigues, Abel, 2019]. In contrast, they are not so abundant in offering criteria to assess which of such models correspond to genuine events and which do not. That is to say, current ontologies seem very effective to allow intended models, but not so much to reject unintended ones. This is particularly evident in the issues of determining the succession of situations that characterizes an event and what its participants are at each time.

Some descriptions share the idea that an event is what happens to a single thing (e.g., an object, a set of properties, a portion of reality) that remains constant throughout the happening of the event and delimits it. With that, it is not just any succession of situations that correspond to a genuine event, but just those in which the situations share such an invariant element. However, the choice of invariant element has some consequences, especially regarding what participates in an event, and current options do not seem to achieve a satisfying tradeoff between these two concerns. For example, defining an event as what happens to a single object gives a good criterion to identify coherent successions of situations, but rules out the possibility of events with multiple participants. Conversely, defining an event to what happens to a constant set of focal properties allows for multiple participants, but depending on how the focal properties are chosen, it may allow events gathering completely unrelated participants.

In this paper we propose adopting the notion of *system* (i.e., a set of interconnected components) as the invariant element that delimits and gives coherence to an event. With that, our goal is providing a clear criterion (1) to assess whether or not a succession of situations corresponds to a genuine event and (2) to determine the genuine participants of an event. The remaining of the paper is structured as follows: section 2 presents a short review of related literature (especially about the notions of situation, disposition, event, and system); section 3 presents our proposal; section 4 brings some illustrative examples; in section 5 we discuss some issues about the proposal; and section 6 brings our concluding remarks.

2. Theoretical Framework

2.1. Continuants, Objects, and Individualized Properties

Continuants are things that *are* in time. They endure or continue to exist through time while maintaining their identity, so that they have no temporal parts and are wholly

present at any time point they are present [Arp, Smith, 2015][Casati, Varzi, 2015]. Continuants include *objects* and *individualized properties*. Objects are continuants that are existentially independent of other entities (e.g., a person, a ball, an atom). Individualized properties are continuants that are existentially dependent on other continuants. They can be either *intrinsic properties*, which depend on a single continuant (e.g., the height of a person, the color of a ball) or *relationships* (e.g., contract imposing obligations between two people, a covalent bond between atoms).

2.2. Situations

In this work, we regard *situation* as an instantaneous, particular configuration of a part of reality that is understood as a whole and that satisfies certain conditions of unity imposed by relations and categories associated with the situation [Barwise, 1989][Herre, 2010][Guizzardi et al, 2013]. Each situation is determined by a snapshot at a given instant [Herre, 2010] of a collection of one or more objects, i.e., a set of attributions referring to individualized properties (intrinsic and/or relational) inhering in such objects, and/or about formal relations among them [Barwise, Perry, 1981][Costa et al, 2006][Guizzardi, Wagner 2011]. With that, situations are continuants disjoint from objects and individualized properties [Costa et al, 2006]. Finally, if a situation *s* is a snapshot of a collection of objects which includes the object *o*, we say that *o is present at s* and that *s includes o*.

2.3. Dispositions

Dispositions are particularized properties that inhere in and are specifically dependent on particular objects (which are the bearers of the dispositions) [Guizzardi et al, 2013][Barton, Jansen, Ethier, 2017][Röhl, Jansen, 2011]. They correspond to what we usually broadly refer to as potentialities, propensities, capacities, capabilities, tendencies, liabilities, and so on [Guarino, Guizzardi, 2016][Röhl, Jansen, 2011][Choi, Fara, 2018]. These properties are characterized by exhibiting characteristic manifestations under some stimulus conditions [Choi, Fara, 2018].

Thus, a disposition is associated with triggering events that bring about a situation gathering the stimulus conditions needed to activate it [Guizzardi et al, 2013][Toyoshima, Barton, 2018][Röhl, Jansen, 2011]. Such a situation leads to a realization event, i.e., an event in which the disposition is manifested and that has its bearer as a participant [Guizzardi et al, 2013][Barton, Jansen, Ethier, 2017][Toyoshima, Barton, 2018][Röhl, Jansen, 2011]. It is also understood that the stimulus conditions for a disposition *d* inhering in an object *x* include some object *y* that is external to *x* and that bears some property that matches *d* [Bunge, 1977]. Moreover, there must be some relationship between *x* and *y* so that the matching properties can be exposed to each other (e.g., it is not simply an allergenic substance that triggers an allergic reaction in a patient, but the exposition - by physical contact, for example - between the patient and the allergen) [Röhl, Jansen, 2011][Bunge, 1977].

A prototypical example is that of fragility of a piece of glass, i.e., the disposition to break in response to being struck [Barton, Jansen, Ethier, 2017]. In this case, the striking event brings about a situation that gathers the stimulus conditions (i.e., a hard object exerting pressure over the glass), leading to the realization event of breaking. Given those features, dispositions are realizable entities that may or may not be manifested or even triggered, but that are still present even if never realized [Guizzardi

et al, 2013][Barton, Jansen, Ethier, 2017][Barton et al, 2018] (e.g. the fragility of a glass is present even if the glass is never struck and/or never breaks). Moreover, with their relation to possible realization events, dispositions are causal properties relevant for and causally explanatory of the events involving their bearers [Barton et al, 2018][Röhl, Jansen, 2011]. By this means, dispositions determine the behavior that their bearers will show under certain circumstances [Toyoshima, Barton, 2018][Röhl, Jansen, 2011].

2.4. Systems

A system is a complex object composed of a collection of at least two interrelated components forming an integrated, unitary whole, rather than a mere aggregate of loose things [Bertalanffy, 1968][Bunge, 1979, p.4][Ackoff, 1999, p.5,8][Backlund, 2000]. Moreover, there are no independent subcollections of components in a system, in the sense there is a path from every component of the system to every other component (through their relations) [Ackoff, 1999, p.7][Backlund, 2000].

Concrete Systems. Our focus in this work is in what is called *concrete system*, i.e., a system composed of material components [Bunge, 1979] (which we will simply call *system* from now on). In this case, components of a system are not linked by mere formal relations (e.g., being larger than). Instead, they are linked by what is called *connections*, i.e., relations through which (at least) one of the relata affects the behavior of the other (e.g., exerting pressure) [Bunge, 1979, p.6][Bertalanffy, 1968]. Here, affecting the behavior of a connected object does not mean causing it to perform or undergo some event, but may simply consist in changing the way the object will behave given certain circumstances. In this sense, the existence of a connection between objects *a* and *b* implies cutting out or opening up of certain possibilities for *a* and/or *b*, modifying their/its behavior trajectory or history [Bunge, 1979], so that their/its behavior is different from that they would exhibit if they were not in such connection [Bertalanffy, 1968, pp.55-56]. With that, the behavior trajectory of the whole system differs from the union of the histories of its isolated components. More than that, it is this interdependence of behaviors that characterizes systems and grants them their emergent properties, which are not shared by any of its components, either individually or in aggregation [Bunge, 1979][Ackoff, 1999, p.8].

Aspects of Systems. Three main facets characterize a system: a definite composition, a definite immediate environment, and a definite structure [Bunge, 1979]. *Composition* is the collection of system's components. *Environment* is the collection of entities that are connected to components of the system or to the system as a whole, but that are not themselves components of the system. Finally, *structure* comprises the connections and other relations among system's components as well as between these and the environment. It is noteworthy that what could be part of a system depends very much on what relations are considered [Backlund, 2000].

2.5. Events

As exposed in the introduction, events are broadly characterized as things that happen in time. We identified two major trends in accounting to the happening nature of events, which we will call *transition view* and *manifestation view*.

In the *transition view* events are transitions among states of the world. The scope of the considered state of the world and how to delimit it may differ from account to account. It may be restricted to a single object, e.g., considering an event as what

happen to a concrete thing [Bunge, 1977, p.221-222, 273][Bunge, 1979, p.22], as the moving of an object through a quality space or as the exemplification of a dynamic property by an object [Lombard, 1998, p. 290]. It may correspond to a local configuration of a part of the world, e.g., with an event being the transformation of a portion of reality from a situation to another [Guizzardi et al, 2013]. And it may also be delimited not by properties of interest, e.g., with an event as whatever happens to a set of focal qualities [Guarino, Guizzardi 2016].

The *manifestation view* is related to the idea that potency is prior to act and that actuality is the unfolding of potentiality [Bunge, 1977, p.183], so that the disposition to do *x* is then prior to doing *x* [Bunge, 1977, p.180]. With that, the potentiality of event unfolding must exist as concrete properties of continuants [Guizzardi, Guarino, Almeida, 2016, p.5]. Therefore, we can say that events are the manifestation (or realization) of such potentiality, which inheres in objects in the form of *dispositions*.

Current ontological support for events (e.g., [Guizzardi et al, 2013]) is effective in conveying a great variety of intended models of this type of entity. The account of events as transitions among situations allows expressing changes in continuants by contrasting their contradictory properties in successive situations. Temporal parts can be seen as subsets of situations in the course of the event. Besides that, combining the transition and manifestation views allows a useful account of causation between events.

In this work we adopt the transition view as most fundamentally describing the happening nature of events. In particular, similarly to [Guizzardi et al, 2013], we regard an event as an entity that links a collection of two or more temporally successive situations (in the sense defined in section 2.2), being a time-ordered transition among them. We will call the succession of situations linked by an event as the *course of the event*. Moreover, we will say that the initial situation in the course of an event *triggers* the event and that the situations that succeed the initial one are *brought about* the event. Finally, an object *x participates in* an event *e* (and then *e involves x*) iff *x* is *present at* some situation in the course of *e*, and what participates in *e* at time *t* is what is present in the situation in the course of *e* that obtains at *t*.

Additionally, we regard the manifestation view as complementing the transition view by specifying the mechanism underlying the superseding of situations. In this sense, a situation triggers an event by gathering the circumstances needed to activate the dispositions that characterize the unfolding of the event. Besides that, the situations an event brings about after that (especially the last one in the course of the event, i.e., the result of the event) can be seen as new configurations of the involved participants after the manifestation of their dispositions.

3. Delimiting Events with Systems

As exposed, the current ontological support regarding events is effective in conveying intended models of events, but not so successful in avoiding unintended ones. This limitation has a considerable impact on the tasks of delimiting the course of an event and determining what can be considered to participate in the event at a given instant.

In the case of delimiting the course of an event, once we have determined the succession of situations that characterizes it, current approaches provide means to describe each of such situations. Nevertheless, there seems to be no clear and widely accepted criteria to decide whether or not a given succession is appropriate to

characterize a given event, or even to decide whether or not such a succession corresponds to any event at all. For example, we can imagine a succession of a situation in which someone presses some keys of a piano in a room full of musicians at a given instant succeeded by a situation of someone else playing a chord on a guitar in the same room and so on. With current ontologies we could easily model an event that is the transition among these situations. However, we are mostly on our own to recognize that this is a good modeling decision if the succession is composed of snapshots of a blues jam, while it is a weird choice if they are just snapshots of an ordinary day in a musical instrument store, with customers trying some products before buying them.

Regarding participation, once we have already decided which continuants participate in an event of interest, existing ontologies provide tools to convey this. However, the issue of how to make such a decision remains largely open. That is, the criteria to determine which participants should be included in a faithful account of the event remains up to the modeler. For instance, in the case of a soccer match in a stadium crowded with team fans, we have well-defined means to model both players and fans as participants of the match, but not so clear grounds to justify why we tend to accept just the players as genuine, lawful participants.

We believe that, in both cases, a solution to the problem may rest on emphasizing an important intuition underlying the notion of events: that it consists in a coherent, cohesive development in reality. In fact, this perspective of cohesion seems to be present in some descriptions of the notion of event. For example, previous section brought descriptions of event as what happens to *one concrete thing*, as the moving of *an object* through a quality space or the the exemplification of a dynamic property by *an object*, as the transformation of *a portion of reality* from a situation to another, and as whatever happens to a *set of focal qualities*. Common to them is the idea that an event happens to *one entity*, which embodies an invariance during the happening of the event. Transposing this idea to the transition view, it means that it is not just any temporal succession of situations that constitutes the course of an event, but just those in which there is some invariant element (be it an object, a set of properties, a portion of reality, or something else) that is present in each of the successive situations.

Besides the coherence among the situations in the course of an event, these descriptions seem also to share the idea that some sort of cohesion is preserved along the event as well, regarding the participants involved in the event. For instance, when describing an event as what happens to a given object, this cohesion is given by the unity of the object. When describing the event as a transformation of a portion of reality from a situation to another, cohesion is provided by the unity associated with the notion of situation (i.e., a configuration that is *understood as a whole* and that satisfies certain *conditions of unity* imposed by relations and categories associated with the situation). With that, it is not just anything that can be said to participate in an event at a given instant, but just what is within the limits of the chosen criterion of unity.

Although these descriptions express the concern that events should be cohesive entities, restricting the possible models of event (e.g., excluding those whose course of event comprises unrelated situations such as the …), they have significant shortcomings. To some extent, the invariant element that delimits an event determines what is included in each of the situations in its course and, in consequence, what participates in the event at each time. With that, the choice of the invariant element that

delimits an event affects how well the set of models the ontology allows reflects the set of intended ones.

The mentioned descriptions present three alternatives of invariant element: a single object, a set of focal properties, and a portion of reality. Adopting a single object as the invariance, we have a clear criterion to define valid courses of event (i.e., those limited to what happens to the chosen object), but it would also rule out the possibility of events with multiple participants (e.g., two people playing chess). Adopting the option of a set of focal properties, we can have models of events with multiple participants, i.e., the different objects that may bear each of the chosen properties. However, there is no clear criterion to decide which properties should be considered in the focal set, which would allow for unintended courses of event. Moreover, if the focal properties must be present throughout the event, it is not possible to have events in which objects are destroyed or created (e.g., the burning of a log into ashes, the making of a statue), since any property of the destroyed object disappears with it and properties of a created object should be considered to account for the notion of creation. Similarly, events with entry and exit of participants (e.g., a soccer match in which some players are replaced) would not be accepted either. Finally, choosing a part of reality as the invariant element of the event, the event may have any combination of participants, only depending on how the part of reality is delimited. The downsided is the arbitrariness in how to delimit this portion of reality, which is completely left to the modeler.

In view of that, following the same approach underlying the mentioned descriptions, we propose using the notion of system as the invariant element that delimits an event. First of all, it is a well defined type of entity that can embody the invariance that provides cohesion to the course of an event, providing a clear criterion to decide whether or not a succession of situations can constitute the course of an event (e.g., ruling out any course of event whose participants are not connected). Besides that, it provides a notion of cohesion for the participants of the event, with participants of an event being just those objects that interact with one another to operate/perform the unfolding of the event. Since systems may have multiple components, they allow events with multiple participants, i.e., each being the component of the system. Finally, with a system being able to survive the variation in its components (e.g., entry/exit or creation/destruction of components), this delimiting element would allow for variation of participants throughout the event.

3.1. Dispositional Connections

Connections are relationships that modify the behavior history of objects. This means that, in certain circumstances, *ceteris paribus*, an object standing in a connection would behave in a different way than that it would behave if not standing in the connection. Dispositions determine the behavior of their bearers by enabling their associated realization events to happen to the bearers. Yet, a disposition is only a necessary, but not sufficient condition for its manifestation [Bunge, 1977], since such an event depends on the presence of both the disposition and its stimulus conditions. In other words, although a disposition sets the path for a behavior of its bearer under certain circumstances, the effective occurrence of such behavior depends on the presence of those circumstances.

With that, let's suppose we have an object o_1 that bears a disposition d_1 which requires conditions c_1 and c_2 to be realized/manifested through an event e_1 which has o_1

as a participant. Let's also assume that there is a relationship r such that if o_1 stands in r with some object o_2, c_2 is established. Now, we can picture two possible scenarios: (1) in which o_1 stands in the relationship r with object o_2 and (2) in which o_1 and o_2 are not related by r. Taking scenario (1), if c_1 is established at time t, both c_1 and c_2 will be present, which activates the disposition d_2, leading to the happening of e. On the other hand, taking scenario (2), if c_1 is established at time t, only c_1 will be present, which is not sufficient to activate d_1, so that e_1 does not happen. In this case, the behavior history of o_1 in scenario (1) is different from that in scenario (2), i.e., o_1 behaves differently upon the establishment of condition c_1 depending on whether it stands in a relationship r or not. Given this difference in the behavior history of o_1 in virtue of $r(o_1,o_2)$, relations r qualifies as a connection.

This example illustrates the fact that any relationship in which an object stands and that provides some of the stimulus conditions for the activation of a disposition of this object can be considered a connection. With that, we can define the notion of *dispositional connection*:

Dispositional Connection $=_{\mathbf{def}}$ a relationship that partially (or fully) fulfills the stimulus conditions of one or more dispositions of one of its relata.

3.2. Activation System

For the manifestation of a disposition d of an object o to occur, a situation gathering the required stimulus conditions for d must obtain. Besides o bearing d, such a situation must include at least some object o' that is external to o, that has properties that match d, and that are in some way connected to o so that d can be activated. In other words, the manifestation of a disposition requires the presence of its bearer and one or more external objects dispositionally connected to it. That is, every manifestation of disposition requires the existence of a system for its activation. Then, every event that is the manifestation of some disposition requires a system in order to happen (which we will call the *activation system*).

On top of this, we can say that the situation comprising the stimulus conditions for the activation of the disposition is a snapshot of the system that is enabling the occurrence of the event. Considering the transition view, we can also say that, given a disposition manifestation, there is a corresponding event consisting in a transition between snapshots of the activation system. This event is the transition from the situation that activates the disposition (i.e., the snapshot of the activation system at the beginning of the event) to another situation corresponding to a later snapshot of the same system after the realization of the disposition of interest.

This recurrent correspondence between the manifestation of a disposition and the transition between snapshots of the system that activated the disposition suggests the pervasive nature of this type of event, which we will call *system-event* (defined below). It is an event whose participants maximally compose a system that persists during the happening of the event and whose connections are responsible for the manifestations of the dispositions that bring about the successive situations in the course of the event.

System-event $=_{\text{def}}$ An event whose course is composed of situations that are snapshots of a single system.

4. Illustrative Example: A Train Trip

"From a peak of running more than 60 trains a day, Eurostar cut service during the pandemic to one daily round trip between London and Paris, and one on its London-Brussels and Amsterdam routes"[3]

Let us consider the term *trip* in this excerpt. It refers to the event in which a train departs from an origin station and travels towards a final destination station, carrying some passengers. During this trip, the train stops by some intermediary stations, at which some new passengers board the train and some leave it. No matter how many stops the train makes, *trip* here refers to the whole trip from origin to final destination. Besides the train and the train driver, any passenger is considered to participate in the trip during the time s/he is onboard, no matter in which station s/he enters or leaves the train. Thus, we could define a *trip* as the *event in which a train goes from an origin station to a destination station transporting some people along this route*. For brevity, we refer to a simplified version of the event, not considering rights and obligations (e.g., having a valid ticket) and assuming that once people board the train, they only deboard when arriving at their destination (i.e., no re-entry during the trip). With that, it is a transport event, comprising changes in the spatial position of its participants.

To illustrate how to model this event according to our approach, we consider a system composed of the train, the passengers, and the train driver, with relationships of *containment* between the train and each of the passengers, and of *being in command* (i.e., having access to the command panel of the train) between the driver and the train. Each of the passengers has a disposition of *transportability* (i.e., capability of being transported moved one place to another[4]) that is manifested in the trip. Its stimulus conditions are two-folded: (1) being inside a vehicle and (2) the vehicle being in movement. The relation of *containment* fulfills (1) since it places people (i.e., the passengers) inside a vehicle (i.e., train), qualifying as a connection between these components. The driver has as dispositions the her/his *driving capability* and her/his *intention* to guide the train towards the planned destination. We consider the driver's access to the controls of the train as a necessary stimulus condition to the manifestation of both dispositions. Then, by partially fulfilling such conditions, *being in command* qualifies as a connection between the train and its driver. With that, we have a system that unifies the course of the trip and establishes a closure w.r.t. what participates in the trip at any given instant, excluding other objects that interact with the participants, but that are not regarded as participants themselves (e.g., stations, traffic controllers), and accounting for the possible variation of participants (e.g., passengers) during the event.

It brings some advantages over previous approaches. For instance, viewing the trip as what happens to the train provides invariance to unify the course of the trip, but cannot capture the nature of a trip as the transporting of people along the route. If the trip is regarded as what happens to a set of focal properties including the spatial positions of the participants as well as their relevant dispositions (e.g., transportability, driving ability), we can account for the nature of the trip as an event of transport. However, it cannot explain why it does not make sense to keep track of certain focal

[3] www.nytimes.com/2021/05/06/business/eurostar-moves-to-double-its-london-paris-service-to-two-trains-a-day.html

[4] wordnetweb.princeton.edu/perl/webwn?s=transportable

properties at certain times (e.g., the position of people who either still have not boarded the train or who have already left it).

5. Discussion

The approach we propose seems to be a step towards a bona fide account for events. With the notion of system we can distinguish a cohesive event from arbitrary/cognitive aggregates of events (either the sum of temporal unrelated courses of event, or sum of simultaneous events with unrelated participants, i.e., what happens to an arbitrary mereological sum of continuants). It advances previous approaches by articulating clearer criteria to assess the adequacy of a succession of situations as the course of an event, to delimit events, and to determine what participates in an event at each time. It is true that the notion of system itself does not provide a full guidance on how to delimit an event since the decision about what should be the components and connections that characterize the system still remains somewhat arbitrary. However, it indeed provides a criterion to rule out certain successions of situations as unsuitable to constitute courses of occurrent (i.e., those whose situations include non-connected participants), while keeping flexibility of participation in the delimited events.

Additionally, it is not a complete departure from previous approaches and can be seen, in some sense, as complementing and refining the previous ones. For example, delimiting an event with a system agrees with the account of event as a *transformation of a portion of reality from a situation of another*, only specifying a general criterion to delimit such a portion of reality. Additionally, a system may be considered, in a loose sense, the *one object* to which the event happens and that delimits it. The difference in our case is that, whereas *what happens to a concrete thing* or *the moving of an object through a quality space* seem to imply that such object is the only participant of the event, our approach describes the event as involving the components of the system rather than the system itself, which is employed only to delimit the event.

Our approach also has some limitations. It focuses on events that are manifestations of dispositions and presupposes the idea that dispositions require external stimulus to happen. Thus, it becomes unable to cover certain events. A remarkable case is the inertial movement of an atomic object. Being atomic, such an object cannot have components and, thus, it cannot be a system in itself. Besides that, since its movement is inertial, such an object is in fact in a state of motion that persists by itself, with no need of any external stimulus to continuously activate some disposition. Thus, it prescinds any additional participant, apparently being a genuine, bona fide event involving a single participant - and thus not delimited by a system.

It is also unable to cover events that happen to mere aggregates of objects rather than systems, i.e., events with non-connected participants. One example is the event of approximation of an object x towards an object y by the former moving towards the latter while it remains at rest. Considering that x is not actively seeking y in any ways, nor being attracted by y (e.g., gravitationally, magnetically), x and y do not compose a system to delimit such an event. Still, it remains the question of whether approximation is a genuine event or it is simply an arbitrary sum of the states of x and y along time, with the movement of x being the only event taking place. E.g., considering an object w that also remains at rest, but 100km far from x, it is an open question what justifies the inclusion of y but not w as a participant of the event beyond the will of the modeler. It

seems to be an arbitrary inclusion, just as we consider the Eiffel Tower and the Redentor Christ as an object any more than a mere, arbitrary mereological sum.

6. Concluding Remarks

This paper proposed using the notion of system as the invariant element that delimits events. With that, our approach provides clear criteria to assess whether or not a succession of situations corresponds to a genuine event and to determine the genuine participants of an event. Thus, it provides guidelines for constraining the set of admissible models of events to exclude those involving participants that have no interaction with one another, while remaining flexible to allow models of events with a set of multiple participants, which can vary while the event is happening.

This approach is part of an ongoing project whose goal is to develop a well-founded account of events. In future work, we plan to extend this approach to include an account of auxiliary events of entry/exit of participants in/from a main event as well as to include a notion of constitution between events.

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