Causation and the Agent's Point of View *

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ABSTRACT: There are philosophers who deny that causal relations actually exist in nature, arguing that they are merely a product of our perspective as beings capable of intentional actions. In this paper I briefly explain this thesis and consider that it needs to be complemented with a basic non-causal ontological perspective which can account for phenomena taken as causal; I then describe what seems to be a good candidate for such an ontology and finally conclude, however, that it cannot dispense with the concept of causation and that therefore is not the kind of ontology that anti-realism about causal relations requires.

Keywords: causation; manipulability; agent's perspective; Huw Price.

RESUMEN: Hay filósofos que niegan la existencia de relaciones causales en la naturaleza argumentando que no son sino producto de nuestra perspectiva como seres capaces de acciones intencionales. En este artículo expongo brevemente esta tesis y sostengo que debe contar con el complemento de una ontología no causal básica que dé razón de los fenómenos que se consideran causales. Luego describo lo que parece ser una buena candidata para tal ontología y concluyo que, sin embargo, ésta no puede prescindir del concepto de causalidad y que, por tanto, no es el tipo de ontología que necesita la mencionada tesis antirrealista respecto a la causalidad.

Palabras clave: causalidad; manipulabilidad; perspectiva del agente; Huw Price.

1. Manipulability and causation

There exists a strong relation between causation and intentional human action. In an important number of cases the cause is a means that we can manipulate to produce or control its effect, as when we say that watering is an indispensable factor in growing garden plants or that we heat a room by lighting a stove. Generally, if A is the cause of B, by suitably manipulating A we can obtain B or avoid it. For this reason, intentional human action becomes an excellent resource for detecting the causal relations between two events, for distinguishing causal relations from spurious correlations such as those that exist among the collateral effects of a common cause, or for discovering the variety of causal factors that contribute to one same effect. But what is more, our experience as agents beginning in our earliest years becomes a relevant factor in learning and developing our notion of causation; it even becomes a necessary condition,

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because if we were not able to manipulate nature, but only observe it passively, we would lack the concept of causation altogether[1].

It is therefore not surprising that there are different philosophical theories about causation based on the idea of manipulability. Among the most important ones are those by Collingwood (1940), Gasking (1955) and von Wright (1971). Generally, theories of this type have a markedly reductionist propensity and propose that the very idea of causation can be defined in terms of human intentional action. Thus, for example, for von Wright (1971, 74):

> […] to think of a relation between events as causal is to think of it under the aspect of (possible) action. It is therefore true, but at the same time a little misleading to say that if *p* is a (sufficient) cause of *q*, then if I could produce *p* I could bring about *q*. For *that p* is the cause of *q*, I have endeavored to say here, *means* that I could bring about *q*, if I could do (so that) *p*.

We can find some precedents of this reductionist conception of causation in the Austrian physicist Ernst Mach and in Bertrand Russell. Mach used to say that the repeated experience of "our voluntary movements in the world" and of "the changes these indirectly produce" would create in us the notion of causal relation that we then project onto nature and apply to relations between events. And he added that this notion is cognitively irrelevant, that we apply it when we do not know the phenomena in question enough and it ceases to matter to us when science allows us to know them better (Mach 1883, 580-581). The version that Russell offers of the origin and character of the concept of causation is not very different. On the basis of the existence of relatively certain natural sequences, we project onto nature the schema of our intentional actions, in which a wish or purpose determines a course of action orientated towards a goal. And this projection consists of interpreting these sequences by highlighting an active element in them, the cause, which, like our intentions, has its own result, i.e. the effect. So the causal action or causal power that we attribute to certain events to produce others is no more than the reflection of the ability of our desires and intentions to generate events. Russell also thought that the concept of causation was unnecessary in fundamental physics, will disappear from all the sciences and should lose the importance that still it retains among philosophers (Russell 1913).

However, attempts to reduce or define the idea of causality in terms of intentional human actions have been running into two serious difficulties. In the first place, they are accused of being circular definitions because human action itself already entails the idea of causation: our actions are the causes of their results or consequences. Furthermore, such definitions show themselves to be excessively anthropocentric and it does not seem that they can account for causal relations in which the cause is not within reach of our capacity of manipulation, as in the case of the causal relation between the mass of the Sun and the orbit of any of its planets (Hausman 1998, 89).

There are, however, other versions that grant special importance to intentional human actions in the analysis of causation but that lack such reductionist intentions.

[1] Woodward says that "if we had been unable to manipulate nature—if we had been, in Michael Dummett's example, intelligent trees capable only of passive observation—then it is a reasonable conjecture that we would never have developed the notion of causation […] that we presently possess" (Woodward 2003, 11).

Cartwright, for example, conceives of causal relations as "effective strategies", nonetheless defending that their effectiveness lies in the nature of things and is independent of our intentions and actions (Cartwright 1983, essay 1). And Woodward addresses the relevance of human actions in the concept of causation by situating them within the larger frame of "interventions" and thus distancing himself from an anthropocentric version[2]. Woodward defends the view that that causal relations are objective, are features of the world (Woodward 2003, ch. 2), but considers that a theory of causation should incorporate, with its ontology, an epistemology that can facilitate the understanding of causal affirmations and clarify their meaning and the determination of their truth value. As regards this aspect he underscores the heuristic importance of experiences in which producing a change, *intervening*, in a variable X entails a change in a different variable Y, as when a certain medication is distributed in a sector of a population affected by a certain disease and it is confirmed that the majority or all of the medicated individuals recover, whereas the rest do not undergo a significant change (Woodward 2003, 94). Of course, as Woodward emphasizes, this approach to causation already presupposes the very notion of causation, because the very idea of intervention is causal, and it also presupposes certain causal information in specific cases: when analysing the results of an intervention it is necessary to know, for example, that the effect in question was not the result of the interference of causes apart from the ones used in the intervention. But it does not follow from this that an approach like that of Woodward is circular because, unlike the theories of manipulability such as that of von Wright, it does not intend to define the concept of causation or translate causal expressions into non-causal ones. It is simply trying to verify, based on certain causal information, the existence of other possible causal relations. Furthermore, this approach should not be branded as anthropocentric and therefore incapable of considering causal relations in which the cause is beyond the reach of human action. Although the above-mentioned notion of intervention intuitively refers to intentional human actions, such as those carried out in an experiment, not all intervention has to have a human origin. An intervention, in short, is any event that changes the value of X in a way that serves to verify whether a causal relation exists between X and Y. And this also takes place in what scientists call "natural experiments". Human actions are events that are considered interventions, not because they are carried out by human beings, but "because of their causal characteristics" (Woodward 2003, 103-107; 2007).

2. Human agency as perspective

Huw Price, however, currently defends a much less realist version of causation. He considers himself a follower of manipulation theory of causation and proposes a definition of causation very similar to that by von Wright:

> […] an event *A* is a cause of a distinct event *B* just in case bringing about the occurrence of *A* would be an effective means by which a free agent could bring about the occurrence of *B*. (Menzies and Price 1993, 187)

[2] Woodward takes up this notion of intervention from Spirtes, Glymour and Scheines (1993) and Pearl (2000).

But his anthropocentrism goes beyond this semantic reductionism and, close to that of Mach and Russell, situates itself at the origin and the very nature of the concept of causation, turning it into a mere product of our peculiar way of being in the world. He defends the view that our idea of causation does not arise in us from the observation of causal relations in nature, or even the temporal sequences that Hume speaks of, but rather of our experiences of performing certain actions in order to achieve certain objectives and getting it right (Price 1992, 514; Menzies and Price 1993, 194). And Price radicalizes this dependence on the notion of causation with respect to our capacity to influence nature intentionally by insisting that it is not a matter of our intentional actions and in general our condition as agents constituting a peculiar form of knowing objective causal relations in the world or having a "privileged access" to them, but that the very concept of causation has no other reason for being than our experience of acting intentionally in our own environment and planning our actions, thus forming part of our point of view as agents (Price 1992, 517); a concept of causation that we project on the world representing as causal relations between events that in themselves are not causal. In short, for Price, causation is "a category that we bring to the world—a projection of the deliberative point of view" (Price 2007, 290). He applies these ideas particularly to the main property of the causal relationship, that is, its asymmetry. According to Price, the irreversibility we attribute to causal relations is no more than the reflection of a limitation proper to our intentional actions, consisting in the fact that although we can configure the future, albeit partially, we are unable to change the past. Thus the temporal asymmetry of causation definitively lies in the fact that "we the agents are asymmetrical", a fact that is perhaps contingent for fundamental physics, but inevitable for us (Price 1996, 145, 167 ff).

To clarify the type of anthropocentrism that he discovers in the concept of causation, Price resorts to different comparisons. He compares this concept with that of "foreigner" (Price 2007, 250). Just as no one is foreign in oneself, but rather such a label is only attributable from the point of view of another person belonging to another country, no relation between events is causal in itself and can only be qualified as such from the point of view of a being endowed with the capacity of acting intentionally on his or her environment. This implies that, just as no foreigners would exist if all human beings were citizens of a global state, causal relations could not exist either in a world in which there were not any beings capable of intervening in nature and achieving certain ends. Price also compares causation with secondary qualities such as colour or taste. These qualities, as we know, are not proper or intrinsic to the things they are attributed to, because being red or bitter depends on the characteristics of our sensory apparatus. Everything that can be said about the object that we describe as red is that it has a disposition to seem red to us (Menzies and Price 1993, 188), but beings with a sensory apparatus that is different to our own may not see that colour, and of course, if all beings with sensory capacities disappeared from the universe, there would be no colours. Likewise, says Price, the cause and effect relation is not a relation that exists in nature independently of us, but rather the way in which we, as intentional agents, interpret some non-causal relations between events.

Price emphasizes that with these ideas on the perspectival character of the concept of causation he does not intend to defend a "simple-minded anti-realism" and is against Russell's claim about the eliminability of the concept of causation from science and philosophy (Price 2007, 253, 290). However, he notes that the link he sets up between the notion of causation and our point of view as intentional agents distances him from those who defend "a causal structure of the world" independent of human beings or even a "physical asymmetry in the world", so that his "sophisticated subjectivism" destroys the metaphysical pretensions of realist theories regarding causation such as those of Glymour, Pearl, Woodward or Cartwright, (Price 2007, 268, 285 ff; 1996, 136).

In what follows I am going to discuss the theory, defended by Price and others, that causation is a product of our point of view as agents and that there is no causal relation in nature independently of human agency. However, I am not going to examine how it is affected by the aforementioned objections of circularity and anthropocentrism, but rather I shall try to complete it in the way I consider most suitable and analyse whether in this way those anti-realist conclusions with respect to causation have adequate justification.

Maintaining that a certain property or relationship R between natural events is anthropocentric and doesn't exist independently of us seems to require providing an alternative property or relationship R' more basic and objective than R that helps explain how the notion of R arises in us and how we use it coherently. So when Price refers to secondary qualities as an example of anthropocentric properties, he is supposing that, for colour, there is a colourless reality (electromagnetic waves) which arouses in us colours and governs our application of them to things; and the same goes for the other secondary qualities. Therefore, a thesis on the perspectival character of causation such as those of Price and others inevitably raises the issue of what kind of non-causal reality suggests to us the notion of causation and allows the correct application of causal concepts and descriptions. There are a few references in this respect in Price's writings, but they are clearly insufficient. Thus, for example, in response to the above-mentioned objection that those who define causation exclusively in terms of manipulability cannot admit relations in cases in which human action is impossible, Price refers to the existence of some "intrinsic features of the situation involved". These features would be "essentially non-causal" and allow relations of analogy to be established with cases in which human action is possible (Menzies and Price 1993, 197). And he even says that thinking of causal concepts as perspectival involves assuming a non-causal world, to which we apply these concepts. It would be a bare Humean world to which, however, science allows us some access (Price 2007, 289-290). But he does not specify what such non-causal features and such non-causal world could be. Below I am going to outline a possible ontology of this type and analyse to what extent this ontology is really non-causal and can constitute a good basis for anti-realist conclusions such as those of Price.

3. Seeking a non-causal point of view

But before going into the details of what could be such a non-causal ontology, let us clarify something about the very concept of causation. Without intending to go into the thorny issue of defining the causal relation, I think it is necessary for what follows to insist on what I consider to be one of its distinctive traits. It is not difficult to agree that the relation of efficient causation is an irreflexive, asymmetric and transitive type of relation. In the strict sense, irreflexiveness maintains that no event is the cause of itself. As Hume pointed out, cause and effect are contiguous but different phenomena, spatially and temporally different. However, this property is usually interpreted in a broader way by insisting on that the cause does not occur in the system on which it has an effect. It is commonly understood that the cause of an event in a system is another event in its environment that provokes a corresponding change in it, as when a rock breaks a piece of glass or the sound of an alarm makes a thief run away. Aronson, for example, identifies an effect with a change that is not "natural", but rather the fruit of an interference coming from outside; a natural change, in contrast, would be one that results from the normal course of events in the absence of external interference, that is, the absence of causes (Aronson 1971, 422). Thus one could not say that childhood is the cause of puberty or that the seed is the cause of the tree; the correct thing to say would be that the child turns into an adolescent or the seed turns into a tree. It is a matter of the old requirement of the exteriority of the cause.

J. L. Mackie has made one of the most detailed recent analyses of the causal relation. Although following John Stuart Mill he maintains that the distinction between the causal field or basic conditions and the cause strictly speaking is always contextual, he thinks that in our habitual use of causal concepts it is easy to find if not strict rules, then enough "systematic tendencies" about how we establish this distinction. Accordingly, we can detect in our causal language a clear tendency to point out as cause an "intruder" event and not those occurring into the system in which the effect takes place. We would admit as the cause of a haemorrhage a cut made by a knife or a piece of glass, but not the pumping of blood by the heart. There is no doubt whatsoever that the pumping of the heart is necessary for a haemorrhage to take place, but not all the factors needed for an effect count as its efficient causes. For this reason, adds Mackie, it is not strange that the search for a cause is normally dominated by the idea of how that effect could or should have been avoided and that, in short, our concept of causation emerges from our experience as intentional agents in the world (Mackie 1980, 31-57). It is not forcing the issue to interpret these considerations of Mackie as a reinforcement of the idea that, in our causal language, the cause normally coincides with a factor that is external to the system in which the effect occurs: an event in its environment. This requirement of the exteriority of the cause, which has a long tradition in the philosophy on this topic[3], will be fundamental to what follows.

[3] Special attention is paid to the exteriority of causes both in Bunge (1959, ch. 7), who echoes this demand of efficient causation in Aristotle and Scholasticism, and in Pearl (2000, 165-171), who presents a more formal version of the notion of causation. Salmon (1993), among others, calls phenomena such as the propagation of a light signal "causal processes", but without abandoning this idea of the

Having made these clarifications on the notion of efficient cause, let us go now to the issue of a non-causal ontology which can support the anti-realist claims about causation we have seen. I think that we can find in Mach the starting point of an ontology of this kind. I shall develop his suggestions and analyse whether the end result is really a non-causal point of view. Emphasizing his idea that causal descriptions tend to disappear when we get to know the phenomena well, Mach wrote:

> Heat is said to be the cause of the tension of the steam; but when the phenomenon becomes familiar we think of the steam at once with the tension proper of its temperature. Acid is said to be the cause of the reddening of tincture of litmus; but later we think of the reddening as a property of the acid. (Mach 1983, 580)

Thus, even though one can say that heating a mass of gas causes an increase in its pressure and/or volume, for anyone who knows the law of ideal gases this causal description is unnecessary, because what this law affirms is the peculiar way in which volume, temperature and pressure come into play in gases. It is not a causal law, but a law that affirms the coexistence of certain properties or, better said, the correspondence between the values of certain variables in the system. In Mach's opinion, the knowledge that science brings us consists of discovering the laws of coexistence or association of properties where, transported by our tendency to project the intentional action-result schema onto nature, we had assumed an asymmetrical relation of cause and effect. I believe it would not be forcing things too much to apply these considerations of Mach to many other laws, if not to all. In the case of the Newtonian laws of movement, although we say that the force exerted on a body is the *cause* of its movement, what happens is that when faced with an external influence, the body reacts by coordinating its dynamic state with its mass; and what the principle of inertia states would be simply the system's tendency to maintain this coordination. The principle of entropy, for its part, would describe, among other phenomena, the way in which a system initiates a characteristic process that leads to thermal equilibrium among its parts when a change in temperature among them has been produced from the outside[4].

This conception by Mach seems to provide us with a basis for outlining a general view of the changes in a system in which these would be no longer viewed properly as "effects", that is, products of the action of a factor that is external to that system, but rather would be considered the states resulting from processes that take place inside the system and that respond to its nature. And in this aspect there are notable differences between this point of view and the causal one. First of all, they are different in

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exteriority of the cause. For him a light signal is a causal process not because it constitutes a series of causes and effects, but because by interacting with another process it is able to change it (for example, by increasing its energy) and to register the interaction (for example, by changing its trajectory or colour). There are, however, theories of causation that do not include the exteriority of causes, for example, that of Mumford and Anjum (2011). But, as I shall defend in session 4, the kind of process this theory contemplates does not properly match the concept of efficient causation.

[4] We can also find this idea in Russell, for whom the importance philosophers generally attach to causation is because they are not familiar with the idea of mathematical function, which represents a non- causal dependence between values and is the goal of most developed sciences (Russell 1913).

terms of their cognitive interest. The causal point of view, which correlates the action of an external factor on the system with a change that takes place in that system, responds basically to the "black box" schema, whereas this other approach, in which the most important thing is to decipher the complex processes with which the system reacts to the modifications taking place around it, reproduces the schema of the "translucent box". As an example we can take the movement of a sunflower over a day. The causal description would point to the attraction of the light stimulus of the sun and its varying relative position as the cause of this movement, relegating to the background the complex and biologically more significant activity of the hormones responsible for the phototropism of the plant, through which it adapts to the turning of the earth so that the rays of the sun keep falling on its petals. In general, this internal process that ends in an "effect" is cognitively more interesting than the external event that served as a trigger. It can be said, in the sense of the previous quote from Mach, that in science, the *how* is more important that the *why*.

Furthermore, there are also important differences between the causal point of view and the other approach that I am outlining here as regards their ontological nature in the identification of the factors responsible for the occurrence of the phenomenon in question, that is, concerning the assigning of an active or a passive role to the elements involved in the production of the effect. The causal point of view locates the activity, the productivity, in the efficient cause: for example, it is the action of the poison in an animal's organism that produces its death. However, in the second approach, the activity moves to the system in which the effect takes place: using the same example, the death of the animal is due to a complicated process that its organism initiates in reaction to the presence of a poison in it. It is true that there are cases in which the contribution or the activity of the system in which the effect occurs is so simple that we instinctively locate the responsibility, the action, in an external agent, as when we say that one ball hitting another causes the latter to move. But in general, and above all outside the context of simple mechanical phenomena, the importance of the activity of the system in which the effect takes place is significantly greater. The movements of the roots of a tree towards the damper areas of its environment comprises a much more complex and interesting activity from any point of view than the supposed attraction these areas exert on the tree.

Highlighting its strong similarities with Aristotle's ideas on intrinsic or structural causes will help us to understand this point of view I have been describing. As we know, in his *Physics* Aristotle distinguished four types of causes: efficient, material, formal and final. Efficient causes are what we normally call causes without more ado, and, as we have seen, they consist of changes in the environment of a system: they fulfil the requirement of externality of the cause mentioned earlier. In contrast, material and formal causes, whose significance is related to the hylomorphic doctrine, are located within the systems themselves. They are intrinsic causes that refer to the composition and structure of systems, that is, they constitute their very nature and generate their characteristic behaviour, thus their explanatory value. As Mackie (1980) reminded us, the selection of the explanatory factors of a phenomenon is always contextual, and it could well happen that in certain situations it is more informative to appeal to intrinsic factors than efficient causes, as when we say that the longevity of a certain building is due to its solid foundations, the quality of its materials, the proportions among its dimensions, and so on. This is a causal explanation, but in the broad sense, that is, appealing to structural causes, not in terms of efficient causation. For all of these reasons it is not an exaggeration to consider that the ontological point of view that I am outlining here has a notable Aristotelian flavour insomuch as it vindicates the metaphysical, cognitive and explanatory importance of the structural and functional factors of systems themselves; a vindication that serves as a convenient counterbalance to the long domination of efficient causation, possibly strengthened by the traditional influence of mechanicism in physics and the supposed supremacy of physics in science.

Also of help in understanding the approach that I have been sketching out is to present internal activity, the reactive capacity of systems, as the result of a "homeostatic mechanism", taking this concept from R. Boyd. In several papers devoted to the concept of natural kind, Boyd proposes a criterion that is far removed from both the essentialist definitions and the constructivist conceptions as regards this topic: he conceives of a natural kind as a "homeostatic cluster of properties". The members of a natural kind not only share a set of characteristic properties, but also a "homeostatic mechanism" that regulates the values of these and guarantees a certain equilibrium. Homeostatic processes in biology regulate the interaction of organisms with their environment; they are the responses to external changes that provide living beings with an independence from their environment that is fundamental for their survival. But Boyd characterizes not only biological species as homeostatic clusters of properties, but also metals. Metals, besides sharing a certain set of properties (thermal and electrical conductivity, ductility, malleability, etc.) also have in common certain homeostatic correlations among the values of some of them (conductivity and temperature, for example) (Boyd 1999, 83-84). While it is true that, regarding the nature of such processes, he maintains that it is a matter of *causal* connections, that is, that the changes in the values of some properties would cause changes in other properties of the cluster characteristic of the natural kind, if we look at the context of this affirmation it seems that what Boyd wanted to make clear was that the homeostatic interdependence of properties in a natural kind is not merely conceptual, nor conventionally established, nor is it an accidental relation, but rather consists of connections of a synthetic nature and endowed with a certain natural necessity, capable of permitting inductive inferences and predictions and of offering explanations of the changes (Boyd 1991, 141-143; 1999, 83). Thus, what Boyd is really postulating is the *nomological*, and not necessarily causal nature of the homeostatic processes in natural kinds. On the other hand, it seems more suitable to consider that the interactions among properties in the abovementioned homeostatic processes obey functional laws or laws of coexistence of properties and not causal laws strictly speaking. If this is so, I believe that Boyd's notion of homeostatic dependence among properties is perfectly retrievable and useful for expressing the internal activity with which systems in general react in the face of certain changes in their environment: an activity which, as we have seen, consists of retrieving and maintaining a particular equilibrium or co-existence among the values of certain variables, which is not a result of mere chance but neither is it causal strictly speaking.

Analysing phenomena by focusing attention on the activity with which systems react to modifications in their environment entails doing without such a historically and currently important metaphysical concept as "causal power", associated with efficient cause. Indeed, consistent with what I have been saying, it is not that heat has the *power* to dilate metals but that metals have the property of responding to the changes in temperature in their environments, recovering their own equilibrium between their temperature and their volume. This elimination of causal powers would be compensated by the decisive importance of the capacities or disposition of systems, inasmuch as these would be what explains their behaviour. Fragility, malleability, or irascibility, to mention some of the capacities or dispositions most usual in the philosophical literature on the topic, refer to certain ways in which the systems react to changes in their environment by activating certain internal processes.

Moreover, the ontological point of view I am presenting allows one to introduce an opportune unification in the meaning of the concept of disposition or capacity[5], as important in the metaphysics of the last few decades as imprecise in their content. Thus, for example, Cartwright, whose realist conception of causation is based on the importance she attributes the natural capacities of things (Cartwright 1989, 145), is confusing as to the way in which capacities act. She generally conceives of them as properties of systems, as in the case of fragility or elasticity, whose realization or manifestation depends on surrounding events or conditions (Cartwright 1999, 73). However, on many occasions she seems to identify capacity with causal power, that is, with the property of making changes in other systems, as when she says that aspirins have the capacity to alleviate a headache or that "electromagnetic forces cause motions perpendicular to the line of action" (Cartwright 1989, 141). In other cases the concept of capacity is extended to comprise both meanings, as when she states that Newton's principles describe the capacities of bodies with mass to move themselves and produce movement (Cartwright 1999, 165). For Bird "a disposition adscription means that the object would give some characteristic manifestation in response to a certain kind of stimulus. The fragile vase would break if struck, the irascible man would get angry even if only slightly provoked, and so forth". And thus both elasticity and malleability would also be dispositions in metals just as fearfulness, loathing or hoping are in humans. However, and as we saw in Cartwright, at other times dispositions become causal powers: cows' milk would have the disposition to nourish and to cause diarrhoea in persons with lactose intolerance (Bird 2007, p. 3, 19, 35). In contrast to this semantic ambiguity, the point of view I am expounding limits and unifies the meaning of the notions of disposition and capacity, identifying them with the characteristic forms with which systems react to changing conditions in their environment, a meaning that, furthermore, is the most common one.

[5] Although for many authors there are differences between dispositions and capacities, I believe that for the purposes of this article I can use them practically as synonyms.

Having reached this point, let us take a brief look at how the ontology I have been setting out contributes its own particular response to a long lasting polemic about the nature of dispositions. There is debate about whether dispositions are causally relevant or not and whether they have some kind of explanatory usefulness or not (See, for example, García Encinas 2011 and Vicente 2004). From what we have seen so far, we would have to conclude that, first of all, dispositions or capacities lack causal relevance from the point of view of efficient causation because they refer to processes and changes that take place *inside* systems and not to their influence on other systems. And secondly, capacities or dispositions nonetheless have explanatory usefulness. In certain contexts they help us to understand certain events, like when we say that a person became ill with flu because of her delicate state of overall health, or that a metal piece deformed because of the high capacity of its material to dilate. One could object that in such cases it is after all a matter of causal explanations, and that is true, but the causes referred to are structural, not efficient.

4. But isn't there efficient causation in internal processes?

However, one could ask whether, despite everything, these processes internal to systems that I have been discussing are not also in turn describable in terms of efficient causation. Certainly an entire biological process intervenes between a snake bite and the death of an animal, and it can be considered as a chain of causes and effects. In principle, this type of causal analysis is always possible, but in a trivial way. If we have defined causation in terms of a system and its environment, and if what is considered a system, and thus its environment, is inevitably conventional, it is always possible to refine the description of an event based on the convenient consideration of more basic subsystems and their corresponding environments, permitting a causal description of what was previously considered a process internal to a system. In a process of poisoning, for example, one can focus on the changes that occur in certain organs and describe them causally. Thus, once the poison has passed into the bloodstream, its influx into the lungs *causes* bronchial spasms and dyspnoea and its presence in the circulatory system *causes* brusque changes in blood pressure. But of course in the opposite direction we can also analyse these changes focusing this time on the intrinsic factors, that is, on the nature of these subsystems, these organs, and how they react to certain characteristics of the environment (in this case the influx of poison through the bloodstream), and the resulting description will not be causal. This permanent possibility serves as a corrective to any thesis about an inevitable and determinant causal reduction of the internal processes of systems.

At this point it is advisable to refer to the approach of Glennan, which is very similar in appearance to the one I have been expounding here, but very different as regards the most fundamental elements. According to Glennan, a distinctive trait of the cause and effect relation is the existence of a mechanism between the two that connects them. And he defines these types of mechanisms in general as complex systems that produce behaviour through the interaction of their parts. Thus, for instance, the turn of a key in a car starts the motor because between one event and the other there exists a mechanism composed of a battery, sparkplugs, pistons, and so on that realizes this causal connection. Causal mechanisms could also be, for example, an articulated float that maintains the water level in a tank or an electrical transformer. But it is not just a question of physical artefacts. This concept of causal mechanism is broad enough to be applied to biological, psychological and social causal relations as well. Other mechanisms in this sense are those that transmit genetic material, and therefore explain Mendel's laws or the mechanism that manages to explain the way in which nicotine and tar interact with the body to produce cancer cells (Glennan 1996, 50, 52; 2002, S344, S348). These mechanisms are understood to offer a type of explanation that could never be offered by mere regularities or statistical correlations. Discovering such mechanisms is equivalent to moving from the mere behaviour of a system (*what a system is doing*) to the description of its structure and internal processes that allow us to know *how it is doing it* (Glennan 2002, S347). And Glennan maintains that his mechanical conception of the causal relation could serve as a foundation to a general theory of causation that would overcome the limitations of Hume's theory without having to include an additional notion of causal, logical or natural necessity (Glennan 1996, 64).

However, Glennan admits that this version of causation has two important limitations. On the one hand it is not free from circularity because the interactions among the parts of these mechanisms are ruled by causal laws. The processes that are triggered inside a system as a result of an action in its environment and that lead to an effect are, in short, causal chains, such that explaining a causal relation between two events is the same as showing causal relations on a more basic level. Hence, Glennan's proposal does not really contribute much to clarifying the concept of causation, although it is not short of a certain methodological or heuristic importance. The other limitation of this approach would be that it is not applicable to the fundamental laws of physics: laws such as the principle of gravity, Maxwell's equations, Einstein's equation that relates the distribution of mass with the curvature of space-time or Schrödinger's equations for quantum-mechanical systems. Laws of this kind would lack a causal explanation because among the phenomena that they relate there are not any mechanisms like the ones Glennan considers: mechanisms whose parts are "objects". Actually, Maxwell's equations, for example, can no longer be explained mechanically: there is nothing like a mechanical environment composed of particles (the old ether) whose interactions could explain the propagation of electromagnetic waves. These laws, according to Glennan, would represent "the gross nomological facts of our universe", about which no explanation is possible (Glennan 1996, 52, 61; 2002, S348). One would imagine that, from this approach, the fundamental laws of physics, which causation no longer reaches, would be simply laws of association or functional laws. In any case, one would have to conclude that we can no longer think of the principle of causation as a metaphysical principle with universal validity (Glennan 1996, 67-68).

I agree with Glennan that, as I have already mentioned, the processes that start inside a system in response to changes in the environment permit a causal reading: all one has to do is find what he calls a mechanism, that is, a relation or chain of relation between different subsystems and their environments. Although, as we have seen, these processes also can be read in terms of what I have been calling coordination of values of variables or homeostatic interdependence of properties. But, I do not agree with him in regards to the fundamental laws of physics. I believe that such laws, just like others, admit a causal interpretation, even though in such cases no mechanisms like the ones postulated by Glennan are present. Thus, for example, it can be said that the Earth's gravitational attraction keeps the planets in their orbits or that it causes bodies to fall on its surface. Although once again the causal interpretation is not the only possible, and, as I have explained, the notions of co-existence of properties, co-ordination of values, and so on seem to provide an ontologically more basic and cognitively more interesting point of view.

I think that it is appropriate to end this session with a brief comment on the Mumford and Anjum's version of causation that I mentioned in footnote 3. For these authors causation is not a relation between spatiotemporally distinct events (as is assumed in what they call "two events model"), but a single "process in which one thing gradually turns into another" or "one property... is replaced gradually by another". A causal process occurs, for example, when sugar dissolves in water or the temperature of a room in which there is a stove increases, taking into account, however, that, in these cases, the cause is not dropping the sugar in the water or switching on the stove, but the system composed by the water-cum-sugar or the system composed by the room-cum-stove working (Mumford and Anjum 2011, ch. 5).

It is easy to grasp that the processes that Mumford and Anjum call causal basically coincide with the internal processes I have been sketching in the previous session. Indeed, the solution of sugar in water is a process with which the sugar reacts according to its nature, namely its solubility. And the heating of the room is a process due to the capacity or disposition of air to spread the kinetic energy of its molecules until reaching a homogeneous distribution, that is, thermal equilibrium. I think, therefore, that these processes can only be regarded causal in a broad sense, given that they result from structural causes, that is, features of systems in which the effect takes place, but they are not causal in the sense of efficient causation, as I have been arguing. It is therefore not surprising that, according to Mumford and Anjum, their model of causation does not admit traits such as (a) the exteriority of cause, (b) its time priority, and (c) the possibility of causal channels: three traits traditionally associated with efficient causation.

5. Causation re-emerges

So far we have been seeing that a perspective focused on the internal processes of systems allows an ontology that can bypass the concept of efficient causation in many important respects. But, can this ontology dispense with this concept entirely? Clearly it cannot. It seems absurd, for example, to attempt to understand our perceptual knowledge of the world regardless of the causal role of objects in our observations. The systems I have been referring to in these pages are not isolated systems like Leibniz's monads, but systems whose internal processes depend on what happens in their environment. The natures of systems, their dispositions and capacities, are unable to explain their behavior by themselves. Such dispositions and capacities are defined, as we have seen, by their way of responding to the changes around them. Then, generally, the behavior of a system, its states and changes is due largely to external factors. And this dependence is causal, according to the condition of exteriority of efficient causes, and objective: it is not the result of an anthropocentric point of view or a mere projection of our condition of intentional agents. In this respect, causation is very different from secondary qualities, because while colours or sounds exist only if there are organisms endowed with a specific kind of sensory apparatus, the causal dependence of systems on what happens in their environment does not need the existence of human beings. Therefore the ontology I have been outlining in these pages, although non-causal in many aspects, and even very interesting from the cognitive point of view, and, as Mach suggested, very consistent with the goals of science, does not provide the aforementioned necessary complement for the refusal of authors like Price to admit the existence of causal relations in nature independently of us, adducing that the concept of causation is the product of our point of view as beings capable of intentional actions.

No doubt that, as said at the beginning of this paper, there exists a strong relation between causation and our intentional actions. Our interests as agents are of great heuristic value: our need for effective strategies helps us to discover causal relations in nature and to distinguish between these and accidental correlations. And the experience of intentional actions seems key to the setting, learning and understanding of the very concept of causation. On the other hand, and in line with what we have seen about the ontological signification of internal processes of systems in the output of effects, it is sensible to think that our condition as intentional actors induces us to grant an unjustified ontological importance to the changes in the environment of systems in which the effects take place, that is, to reduce causes to efficient causes, because these are very often events that we can provoke or control directly with our interventions, unlike what occurs with the processes that take place inside systems. Perhaps this explains partially the relevance that the notion of "causal power" has come to acquire in ontology. All these anthropocentric aspects of causation indicate that the production of phenomena in nature is much more complex than the efficient cause-effect relation includes; however they are not capable of becoming a solid argument against its objective existence.

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