An Interdisciplinary Focus on the Concept of Causation: What philosophy can learn from psychology.

Leen De Vreese
Centre for Logic and Philosophy of Science
Ghent University, Belgium
Leen.DeVreese@UGent.be

13th December 2006

Abstract

In philosophy of science, it is still a mainstream practice to search for the 'truth' about fundamental scientific concepts in isolation, blind to knowledge achieved in other domains of science. I focus on the topic of causation. I argue that it is worthwhile for philosophy of science to leave its metaphysical tower in order to pick up knowledge from other domains where empirical research on causal reasoning is carried out, such as psychology. I will demonstrate what the psychologist Peter White's theory, on the origin and development of causal reasoning, can impart to philosophy of causation. It concerns different but interrelated subjects with respect to the philosophy of causation: conceptual pluralism, a core causal concept of causation, the analysis of "what causation is", epistemological pluralism, causation as a secondary quality and weak causal realism. The divide between metaphysical and epistemological approaches to causation—and hence between philosophy and psychology—may be much smaller than is often presupposed.

Keywords: philosophy of causation, developmental psychology, causal pluralism, interdisciplinarity

1 Introduction: Do we Need to Live in a Metaphysical Ivory Tower?

> It is curious how similar two disciplines can sometimes seem when in reality they are on opposite sides of a great divide. Philosophers are concerned, roughly speaking, with what causation actually is (...), whereas psychology is not. Rather, psychology is concerned with how people understand and perceive causation, make causal inferences and

> attributions, and so forth. (...) Philosophy and psychology therefore engage in inquiries of different kinds, and the superficial resemblance of the questions asked in each should not be allowed to disguise their basic differences. (...) philosophical theories and notions can serve as models for psychological theories, in which rationalist questions about possibility and so forth are effectively translated into empirical questions about matters of fact.[15, p. 10-11]

In the sequel of the article in which Peter White claims all this, he proposes some lines of psychological research extracted from philosophical issues on causation. As a psychologist, he may not be interested in the opposite movement — namely of philosophical research incorporating psychological results. However, the great divide White is talking about rather seems to imply a conviction that a mutual pollination between philosophy and psychology is unfruitful for philosophy.

A lot of philosophers of science would probably agree on this one-way traffic. Their obvious argument will be the same as White's: that in philosophy, one is not concerned with how people understand causation and make causal judgements and so on — as is the case in psychology — but rather with what causation *actually* is.

It is indeed still mainstream practice in philosophy of science to search for *the* truth about fundamental scientific concepts, such as causation, in isolation, blind to knowledge achieved in other domains of science. Philosophers often develop their theory on the basis of previous philosophical work and rather intuitive ideas on everyday or shallow examples. All this happens without any or with only some negligible input from other domains of science. These theories made up in an ivory tower are afterwards nonetheless claimed to explicate *the* truth about the causal structure of the world, in opposition to the rival tower products. One can claim that this non-empirical way of developing theories is precisely characteristic of philosophical research. Finding out what causality actually is in the world is then taken to be a metaphysical matter and hence supposed not to be helped forward by psychological empirical evidence on causal reasoning.

I am, on the contrary, convinced that we should have an eye for the results of other domains of science to develop relevant philosophical approaches. As John Dupré states:

> We should avoid metaphysical doctrines for which we neither have, nor possibly could have, empirical evidence of applicability.[7, p.201]

If he is right, something is going wrong in the philosophy of causation. And indeed, the armchair-views developed in philosophy are often not in line with the findings and data from other fields. Furthermore, all theories on the market seem to be explicating or indicating (as well) some way for people to infer causal relations. The divide between metaphysical and epistemological approaches to causation—and hence between philosophy and psychology—may be much smaller than presupposed by White. Bridging the gap and organizing some traffic

in both directions would then not be such a foolish idea. As Lynne Rudder Baker puts it aptly:

> Instead of beginning with a full-blown metaphysical picture, we should begin with a range of good explanations, scientific and commonsensical... Although my proposal has a strong pragmatic cast, it is by no means an anti-realist suggestion. I am not equating what is real with what is needed for explanations and predictions. The point is, rather, that we have no better access to reality than what is required for cognitive success, construed broadly enough to include what is cognitively required for achieving goals in both science and everyday live.[1] Cited in Ref. [2, p.529-530]

In this article I will argue that it is worthwhile for philosophy of science to leave its metaphysical tower and to cross the bridge in order to pick up knowledge from other domains where empirical research on causal reasoning has been carried out. I will do this precisely by demonstrating what Peter White's own psychological theory on the origin and development of causal reasoning can impart to philosophy of causation. In section 2, I will first summarize Peter White's ideas. In section 3, I will describe what philosophy of causation can learn from the psychological approach of Peter White. It concerns different but interrelated subjects with respect to the philosophy of causation: conceptual pluralism, a core causal concept of causation, the empirical analysis of what causation is, epistemological pluralism, causation as a secondary quality and weak causal realism. In the concluding section, I return to the more general question of what we gain by interdisciplinary collaboration.

2 Peter White's Psychological Theory on the Origins and Development of Causal Processing.

In Ref. [13] Peter White reviews the psychological literature in order to develop a theory on the origins and development of causal processing. His theory incorporates some interesting facts for consideration in philosophy of causation. In this section, I will give a summary of the approach highlighting particularly those aspects which deliver brain food for philosophers. For the details, I refer the reader to Ref. [13] and Ref. [14].

[1] This was stated within the framework of an article on *Metaphysics and mental causation* but seems to apply to causation in general.

2.1 The Origin of Causal Processing in Automatic Iconic Processing

The basic idea of White's theory is that causality is a *developmental primitive*.[2] This means that we have some causal conception from a very early age. This makes infants automatically perceive certain events as causally related. Hence, children are preprogrammed to interpret certain phenomena as causally related. In White's theory, iconic processing plays a central role in the early development of causal processing. The iconic store or visual sensory memory is a store where visual information is held for a brief amount of time before it is attentively processed. One function of iconic processing is the integration of information about events happening at different times within 250 milliseconds apart. This is called *temporal integration*. According to White, temporal integration in iconic processing forms an appropriate basis for the development of causal processing.[3] Let me clarify this by way of an example. An infant perceives a moving hand touching a toy that then rolls away without perceptible delay. In fact, it is then confronted with a conflict between on the one hand one process of continuity of motion, and on the other hand two clearly distinct entities to which this process applies: the hand and the toy. Through temporal integration the conflict is solved. The movement of the hand and the subsequent movement of the toy are interpreted as one singular event involving the two entities and the transfer of the property of motion from the former to the latter. This perception of continuity relations within the iconic time scale involves a first rudimentary conceptualization of a causal relation. Psychological evidence shows that this early form of causal perception is already present at an age of 3 months. This means that the rudiments of causal processing are already present at this early age. It does not entail that causal processing is innate, as some have argued. Only the processing mechanisms necessary for (amongst others) the emergence of causal processing are.

2.2 Four Basic Causal Cues

The causal relations perceived within the iconic time scale always have four invariable features according to White: *temporal contiguity*, *spatial contiguity*, *temporal ordering in possession of the transferred properties*, and *similarity of transferred properties* before and after transfer. These four cues are taken to be basic cues for causal processing. Hence, Peter White hypothesizes that these properties form the point of departure for the further development of causal processing. Some evidence exists that the four cues to causation maintain an important role in causal reasoning of children as well as adults. However, they may be violated under the influence of more mature developments in causal reasoning. Temporal contiguity is, for example, violated whenever one localizes a

[2]This is the term used by Corrigan and Denton[5] to describe White's ideas.

[3]There is some evidence for the existence of a pre-attentively echoic store, which may clarify how causal processing develops in a parallel way in congenitally blind children.

cause on the basis of a regularity cue which links the cause to an effect turning up with a certain delay. For example, a mother notices that her infant comes out in a rash whenever it has been eating strawberries. This regularity will lead her to the conviction that the eating of the strawberries causes the subsequent rash of the infant. It is in this case the intrusion of the later developed regularity cue, that overrides the temporal contiguity cue.

2.3 Further Development of Causal Processing on the Basis of the Basic Cues

Further developments of causal processing on the basis of the four basic cues can involve the perception of these characteristics in the relations between other types of events, at higher levels and on longer time scales. I will demonstrate this by way of a hypothesis of White himself, which explains how iconic causal processing may be generalized to incorporate intended human behavior. For that purpose, the time span of the relation between the involved events has to be lengthened than for the iconic time scale. Furthermore, the cues need to be applied to the relation between an internal and an external event instead of to the relation between two external events. I will give a concrete example. A child intends to grab hold of a ball. It seizes the ball and perceives the result of this action. It can then compare this perception with the information about its plan stored in short-term memory, to ascertain that it has realized this plan. The information from short-term memory corresponds with the result of the child's action. Hence, it succeeded in carrying out its plan. In this example, the child is again confronted with two clearly different impressions (the mental image of the intended action and the perception of the result of his action), which are nonetheless characterized by a high similarity. The four cues of causation the child is familiar with from perceiving continuity relations between two physical events, seem to be present in this case as well. The internal plan and the external effect are highly similar. The former precedes the latter. Given the limited behavioral plans an infant is able to make, they will be separated by very little time. And although spatial contiguity cannot be met exactly, the mental plan in the child's head and the subsequent action by the child's own actions seem to be as close in space as an external event can be to an internal one. Hence, the child will be able to perceive the internal event as causing the external one. This example explicates how the generalization to other domains and the abstraction of the basic cues of the continuity relation (e.g. the abstraction of the spatial contiguity cue in this case) can lead to the perception of causal relations between other kinds of events.

2.4 Generative Relations

The primitive developments of causal processing seem to lead to a first full-blown causal conception, which is shown to remain fundamental for

causal processing of horizontal causation during one's whole lifetime. It concerns a core causal conception in terms of generative relations. Interpreting causation as a generative relation between events means understanding a cause as something that *actually* produces or brings about effects. An observer can perceive, know or believe in such a generative relation between a cause and an effect when making causal inferences. As White puts it:

> People understand the causal relation as a generative relation involving a causal power of some thing, the operation of which actually produces an effect.[14, p.431] [4]

Following Schultz (in Ref. [13]), this productive relation would concern transmission of energy in the case of physical events. According to White, this interpretation may replace or underpin the former interpretation of physical causal relations in terms of the less abstract notion of transfer of properties. In the case of human causation on the other side, the generative relation concerns the enactment of intentions, which may form an abstraction of the earlier causal interpretation of intentional relations as well (see 2.3.). However, it is clear that the cues to these generative relations are of a mechanistic kind (e.g. information showing how the cause can lead to the effect, perception of intermediary processes), pointing to the process going on between the cause and the effect. It is shown by Schultz (in Ref. [14]) that children of two to three years old do understand at least physical causation in this way and prefer the causal cues pointing to a generative relation to other cues to causation, such as covariation, spatial contiguity, temporal contiguity, temporal priority, and similarity. This result was replicated with children growing up in the West African bush, which shows that this core causal concept in terms of generative transmission is not dependent of culture. Adults, too, as well still seem to prefer this cue to causation to other cues such as correlation.[1]

2.5 Naive Theories of Causation

As has been shown by Corrigan and Denton[5], these developments are connected to the development of domain-specific theories of physics and psychology, including knowledge about physical and personal-human causation. The domain-general notion of causality in generative terms is used together with domain-specific knowledge of causal relations to develop basic theories of causation for some specific domains. There is a consensus in psychological literature that children actually develop a naive theory of physics and a naive theory of psychology. There is some disagreement, however, on whether they develop some other core theories as well, for example for causal reasoning in the domain of biology. In even further development, causal processing also

[4] This view on causation is related to the philosophy of causation of amongst others Bunge[**?**] and Harré and Madden[**?**]. The recent revival of this kind of views in the philosophical literature on causal mechanisms has been primed by Glennan[**?**] and Machamer[10].

incorporates other cues to causation, such as familiar event sequences, regularities and correlations. Although the generative causal conception is shown to be fundamental, causal cues not directly related to this conception remain important. They will be used in controlled causal processing, especially when something unexpected happens (see next section), or when one is, for example, reasoning over multiple occasions. White is not clear on the point whether some of these alternative indicators are developed into full-blown causal conceptions or whether they are just used as possible cues to causation. Although this may not be the case in normal subjects (White states there is evidence that people continue to use correlational cues to causation imperfectly), I would maintain that some of the cues (such as correlations, conditional cues, regularities) can be used as a basis for the theoretical development of alternative causal conceptions through explicit reasoning on causality. However, White maintains that these cues to causation are not as basic as cues to the generative concept, contrary to what has often been claimed in psychology. Whenever it is possible, people are inclined to fall back on the generative conception to make causal inferences.

2.6 From Implicit to Explicit Causal Processing

The development of causal processing is also characterized by the transition from implicit to explicit understanding of causation, and as a consequence, also from automatic to controlled causal processing. Peter White has strongly emphasized this distinction.[13] [14] In origin, causal processing happens entirely in an uncontrolled way in iconic processing. Once the basic cues involved in this implicit causal concept have been abstracted and generalized to other domains and levels of knowledge, they can be used to perform controlled causal reasoning. However, automatic causal processing does not disappear at this point. A lot of causal processing will still be performed inattentively by way of iconic processing or in terms of our basic causal concept of generative relations. This happens when things are obvious to the observer. Controlled causal processing is activated when this automatic causal processing breaks down because something unexpected, abnormal or uncomprehended is happening. Because of this, White even states that controlled causal processing is in fact the most uncharacteristic form of causal processing. Further, White maintains that causal processing in terms of covariations is a late development. Although it is not at all basic to causal processing in his view (as is nonetheless argued by a lot of probabilistic orientated psychologists), it may for this reason be an important cue for abstract controlled causal processing. Moreover, controlled causal processing is to a large extent determined by the practical concerns which have led to the controlled causal reasoning process. Regularity and covariation information are, for example, specifically preferred for those types of causal questions referring to multiple occasions. In Ref. [16] White explains more concretely how the type of causal question that is posed, determines the type of preferred causal information.

2.7 Summary

To sum up, White maintains that people have a domain-general core concept of causation in terms of a generative relation which is rooted in pre-attentive iconic processing mechanisms. This core concept is clearly related to the mechanistic approach to causation in philosophy, which states that A is a cause of B if there is a process through which A brings about B. According to White, this core causal conception has developed through the application of the four basic cues to iconically perceived continuity relations to other domains and levels of knowledge. By abstracting and generalizing the causal cues which have led to, and are involved in, our basic causal conception, causal processing may further develop to be of use in other domains of application. In the later development of causal processing, other causal cues (such as regularity, human interventions, correlations) are nonetheless incorporated as well. Although we easily fall back on our core conception of causation in terms of generative relations, these alternatives are important too, and of particular use for controlled causal processing. The use of the divergent causal cues in controlled causal processing further depends on practical concerns. This way, White opposes psychological theories on causal reasoning in which only one causal concept is important for causal processing.

3 What Can Philosophy on Causation Learn from All This?

Instead of performing an analysis of causation on the basis of a range of good (causal) explanations, as was proposed by Lynne Rudder Baker (see section 1), I want to go even one step beneath this in the current section. The psychological evidence reviewed in the previous section does not focus primarily on the formation of good causal judgements itself, but rather on the foundations of our causal concepts underlying our causal view on the world. Looking into the origins and developments of these conceptions may enrich our view on what causation is. In this section, I will try to show how the theory of White can enrich our philosophical view on causation.

Although Peter White's theory is founded on the results of psychological experiments, both the experiments and hypotheses are partly fragmentary and lacunal. A lot more research into the origins of causal processing needs to be done to further underpin his ideas. It is nonetheless striking that White's theory can offer evidence for some recently arisen philosophical ideas which were developed totally separate from psychological evidence on causation.

3.1 Conceptual Pluralism

A lot of psychological research has concentrated on trying to find one causal conception underlying our causal judgements. Most of them have concentrated on regularity or covariation information as a basis

for causal processing. What becomes clear from the alternative picture drawn by White, is that one kind of conceptualization of causation which is (1) present from early childhood and (2) able to be our overall guide in making justified causal judgements, does not exist. Further, causal concepts in terms of regularity and covariation do not seem to be basic at all, but rather late developments in causal processing.

In philosophy of science as well, it is a mainstream practice to try to capture causation in a monistic way. Is an alternative pluralistic approach to causation desirable in philosophy as well? Of course we have to keep in mind the difference between psychological and philosophical approaches, as Peter White pointed out (cf. section 1). Nonetheless, the White's review shows that all the available philosophical accounts seem to be explicating or indicating (as well) some way in which people may actually infer causal relations. All have their counterexamples and shortcomings as well. Just as only one basic causal concept does not seem sufficient for actual causal reasoning, none of the philosophical approaches seem to be able to capture *the* causal relation or *the* causal reality in a unified way. This may be the fate of all attempts to arrive at a full-blown metaphysics covering the total causal reality on the basis of one causal concept. Consequently, recent work of for example Christopher Hitchcock[8] [9] and Nancy Cartwright[4] proposes to adopt a pluralistic approach to causation in philosophy of science as well. They do so because they are convinced that *the* causal relation does not exist but rather that there are different kinds of causal relations. Our view on causation needs to account for this by admitting different causal theories related to different justified perspectives on what causation is. Monistic philosophical accounts, on the contrary, extrapolate only a part of the multi-faced concept of causation pretending to capture in this way *the* truth about it all.

White's psychological theory provides empirical underpinning for the pluralistic approach in philosophy. If an adult person has developed and uses a whole arsenal of different causal cues (part of them not directly related to the core causal conception), this may reflect that this is necessary for people to get a grasp on the causal reality. People may not be able to fully grasp the causal relations in the world when using a singular approach to causation, just as philosophers may not get a full grasp on what causation is when they try to define this on the basis of one concept of cause.

3.2 Core Causal Conception

The divergent approaches to causation are nonetheless not totally unrelated. From White's psychological point of view, humans develop from the pre-attentive causal conception a core causal conception involving the minimal definition of a cause as something that actually produces or brings about an effect. Even when further development in causal processing has been achieved and other cues to causation have evolved, people easily fall back on this basic conception in causal processing. The idea of a core causal conception based on a rather weak defini-

tion in terms of 'bringing about' can clarify what keeps a pluralistic approach to causation together. Although different approaches take different perspectives towards causation, they all comprise a central notion of 'cause'. As Boyer[3] indicates, this may demonstrate that the causal reality is so complicated that this rudimentary description is the only unifying property discerning causal from non-causal events.

Alternative concepts seem to concentrate rather on the consequences of this generative relation. That the occurrence of cause A, increases the probability that effect B occurs, is a consequence of the generative relation between A and B—just as the fact that one can discern a regular co-occurrence of A and B, or that whenever A occurs, B subsequently occurs as well.

Nonetheless, this basic causal concept is not always applicable to discern causal relations. As White maintains, we do not always possess the appropriate information. But what is more, in some domains it may be simply impossible to receive this information (this is the case for fundamental physics, see Ref. [**?**].

3.3 Analysis of "What Causation Is in the World"

If it is the case that the causal reality is so complicated and multifaced that it will never be definable by one approach, a general metaphysics of causation cannot tell anything more than this: the world is rife with a jumble of causal relations of all kinds, in all domains and on all levels.

It seems that we need to impose our causal conceptions on this reality to be able to discern some specific relations in this complex causal structure. White demonstrated that we already do this pre-attentively. From our primitive causal notion resulting from iconic processing, we further develop our causal concepts by generalizing and abstracting its characteristics in such a way that they are applicable to other domains. Hence, our picture of what causation is results partly from reality and partly from the structures we impose on it to be able to reconstruct the relevant relations within. This analysis of "what causation is" is related to the view that causation is a secondary quality, which we will further elaborate on in section 3.5.

John Dupré maintained that:

> We should avoid metaphysical doctrines for which we neither have, nor possibly could have, empirical evidence of applicability.[7, p.201]

In stating this, John Dupré precisely argues against authors underestimating the complexity of causal influences. Awareness of this complexity shows the limitations of our causal conceptions. If referring to the inextricable complexity of the causal reality is the only thing a general causal metaphysics can do, this explains precisely why it will never result in an applicable overall causal metaphysics. For example, Dowe[6] seems to give an analysis of that causation is similar to our pre-attentively conception of cause and the resulting generative picture of physical causation in terms of transmission of energy. But we are

developing this concept further. In the domain of human action, it is for example given another interpretation in terms of enactment of intentions. All this serves the further development of new cues to causation as well. Consequently, one can maintain that our understanding of what causation is indeed evolves from the idea of transmission of energy. But it seems nonetheless impossible to reduce all causal relations to this point of origin. Otherwise our causal processing would not have developed further from that point. As a consequence, Dowe's point of view is an example of a metaphysics with a limited empirical applicability. If one aims on the contrary at a richer metaphysics, as John Dupré does, the alternative is indeed to develop (metaphysical) approaches which are limited to certain domains or certain kinds of causal relations.

3.4 Epistemological Pluralism

This leads us to the topic of epistemological pluralism. Epistemological pluralism with respect to causation is supported by the psychological evidence as well. White offers us considerable evidence that an adult person makes use of different and divergent causal cues to causation to discern causal relations. Furthermore, he maintains that controlled causal processing is to a large extent guided by practical concerns and interests. This supports a pluralistic epistemology: there are different ways to achieve justified causal judgements. Which way we prefer, may result from the information we have, our interests in looking for a cause and the domain we are reasoning in. On the other hand, this means as well that our way to know the causal world will always be perspectival: what we will select as *the* cause depends on our causal beliefs, our background knowledge, our interests and in some cases on the causal concept we are reasoning from as well (for examples of the latter: see Ref. [9]). I've argued before that some causal conception can be more fit for causal reasoning in one domain, while some other or some combination can be more appropriate for making causal judgments with respect to another domain, etc.[12]

3.5 Causation as a Secondary Quality

Evidence for empirical applicability of the philosophical accounts of causation can of course be given to a relevant degree, because they are precisely based and defended on the basis of real-life examples. However, we can never take a step out of reality to have a bird's eye-view on what causation is. We will always have to start thinking in one way or another from how we already think about causation. This is in accordance with the psychological evidence that the basics of causation are developmentally primitive and with White's insight that automatic causal processing permanently plays an important role in our mental world.

What causation is, is hence determined by what we ourselves label as 'causes'. On the other hand, what we label as 'causes' is on its turn determined by the causal structure of the world. Both are always

intertwined so that we can never get a full and precise description of even a limited part of the causal reality. On the other hand, the conceptions that are actually used in causal reasoning will always reflect properties of the causal reality — this sometimes in a very inaccurate way, and in other cases in a much more precise way.

My view leans on the conviction that our causal conceptions — be it implicit or explicit — do not develop wildly. In other words, our causal conceptions have to represent the causal reality to a certain degree. Otherwise they would not be useful in practice. Of course we can have biases and wrong causal beliefs influencing our causal judgements. But generally taken, there should be some causal truth present in our implicit and explicit representations of the causal world. This is why our philosophical approach to causation has to take on board empirical evidence on (the development of) our causal conceptions. On the other hand, we can never abstract our view on reality from the influences of our causal conceptions. Our causal judgements result inevitably from a limited point of view in which the real causal structures we discern and the mental causal structures we impose on this reality are always intertwined. Consequently, we always reason in a perspectival and fragmentary way, although reflecting causal reality, our way to perceive it and discern causal relations in it, is co-responsible for the resulting picture.

This can also qualify the way in which causation is a secondary quality. This claim was made by Menzies and Price in Ref. [11]. It is, however, clear that I do not subscribe to Menzies' and Price's argument that this fact adds support to the agency approach to causation as the only right approach.

3.6 Causation in Science: Weak Causal Realism

But what about science in this whole story? It is clear that the psychological evidence is in the first place directed towards commonsense causal reasoning. As White[14] explains, there are some clear differences with scientific causal reasoning. First, the standards for scientific causal reasoning lie much higher in the desired level of accuracy as is the case for commonsense causal reasoning. Second, the usual aim in science is to establish causal generalizations which explain types of occurrence rather than singular events. Because of this, the development and use of abstract cues to causation, such as correlations, becomes indispensable. Lastly, scientific explanations often refer to some novel causal knowledge while commonsense reasoning usually falls back on known causal mechanisms.

Scientific reasoning is indeed situated at a very abstract level of controlled causal reasoning. This way it gets a broader and deeper view on causal relations than one gets in everyday live. As a consequence, science can discover more and more causal patterns. By making all suppositions explicit and hence testable it is further able to reduce fallacies in causal reasoning. This way science offers us tools to come closer and closer to what the structures in causal reality are.

However, the abstract causal processing in scientific research is nonetheless based on the abstraction and developments of our more basic causal concept and cues. For this, scientific causal knowledge will also be influenced by the way humans reason causally and hence never unveil a fully neutral causal picture of the world.[5] Consequently, I underwrite a weak causal realism. Our scientific causal world view will always be constrained by its fundaments: our metaphysical assumptions, our causal conceptions, our limited point of view. We can never completely free ourselves from these foundations. The result would, after all, be the absence of any theory at all and leave us with a complex inextricable jumble of impressions.

4 Conclusion: the Advantages of Leaving the Tower.

My point of view as explained in the previous section is not at all purely psychological, but nonetheless clearly supported by the knowledge derived from this discipline. One can see how I demonstrated how even philosophers concerned with what causality is, can learn from the empirical evidence on actual causal reasoning and its origin and developments. To see this, one does not even need to favor my point of view on causation.

The previous section shows how evidence from psychology can deliver brain food for philosophers. Paying attention to this evidence can provide us with a clearer view on the reasons for developing certain causal concepts, the limitations of our causal concepts and the degree to which we can separate this from what causal relations actually are. Inconsistencies between psychological evidence and our philosophical approaches point to possible problems or non-obvious elements which need further argumentation. For example, if one prefers a monistic point of view on causation, one can wonder why we should need and use divergent cues to causality to make good causal judgements in practice. Either one needs to bring up thorough reasons clarifying this discrepancy, or one should possibly adapt his point of view.

Conversely, philosophy can offer a frame and tools for psychological research on causal reasoning. This is what White already demonstrated in Ref. [15]. It can further reflect on the way experiments have been carried out, and it can give advices for further research which is important for the philosophical point of view as well.

I hope to have convinced the reader by now that the great divide is after all not so great. Although each discipline has its own individuality and characteristics, the importance of mutual interdisciplinary collaboration between philosophy and other domains of science delivering empirical evidence on philosophical topics can result in important

[5]It is clear Peter White would not follow me at this point. He is clearly someone still believing that we can totally abstract from our practical concerns and all biases and limitations influencing our causal conceptions in scientific causal reasoning. And hence he seems to believe in the ability of science to discover the *true* causal reality.

progress and insights in our view on the world.

Acknowledgments

I would like to thank Erik Weber and Catherine Verguts for useful comments on a former draft of this paper.

References

[1] P. A. White, Ideas about causation in philosophy and psychology. *Psychological Bulletin*, **108** (1), 3–18 (1990).

[2] J. Dupré. *The Disorder of Things. Metaphysical Foundations of the disunity of Science*. Cambridge/Londen, Massachusetts/England: Harvard University Press (1993).

[3] J. Van Bouwel, Individualism and holism, reduction and pluralism: A comment on Keith Sawyer and Julie Zahle. *Philosophy of the Social Sciences*, **34** (4), 527–535 (2004).

[4] P. A. White, Causal processing: Origins and development. *Psychological Bulletin*, **104** (1), 36–52 (1988).

[5] P. A. White, A theory of causal processing. *British Journal of Psychology*, **80**, 431–454 (1989).

[6] R. Corrigan and P. Denton, Causal understanding as a developmental primitive. *Developmental Review*, **16**, 162–202 (1996).

[7] M. Bunge, *Causality. The place of the causal principle in modern science*. Cambridge: Harvard University Press (1959).

[8] R. Harré and E.H. Madden, *Causal Powers*. Oxford: Blackwell (1975).

[9] S. S. Glennan, Mechanisms and the nature of causation. *Erkenntnis*, **44**, 49–71 (1996).

[10] P. Machamer, L. Darden, and C.F. Craver, Thinking about mechanisms. *Philosophy of Science*, **67**, :1–25 (2000).

[11] W. Ahn and C.W. Kalish, The role of mechanism beliefs in causal reasoning. In: F.C. Kiel and R.A. Wilson (Eds.), *Explanation and Cognition*. Cambridge, MA, MIT Press, 199–225 (2000).

[12] P. A. White, Causal powers, causal questions, and the place of regularity information in causal attribution. *British Journal of Pscyhology*, **83**, 161–188 (1992).

[13] C. R. Hitchcock, Causal knowledge: That great guide of human life. *Communication & Cognition*, **31** (4), 271–296 (1998).

[14] C. R. Hitchcock, Of humean bondage. *British Journal for the Philosophy of Science*, **54**, 1–25 (2003).

[15] N. Cartwright, *Causation: One word; many things*, Causality: Metaphysics and Methods Technical Reports (Discussion Paper Series), http://www.lse.ac.uk/Depts/cpnss (2002).

[16] P. Boyer, Causal understandings in cultural representations: cognitive constraints on inferences from cultural input. In: D. Sperber, D. Premack, and A.-J. Premack (Eds.), *Causal Cognition. A multidisciplinary debate*. Oxford, Clarendon Press, 615–644 (1995).

[17] P. Dowe. *Physical Causation*. Cambridge, UK: Cambridge University Press (2000).

[18] L. De Vreese, About a pluralistic approach to causation.

[19] P. Menzies and H. Price, Causation as a secondary quality. *British Journal for the Philosophy of Science*, **44**, 187–203, (1993).