**Mechanisms and Constitutive Relevance[[1]](#footnote-2)\***

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Abstract: This paper will examine the nature of mechanisms and the distinction between the relevant and irrelevant parts involved in a mechanism’s operation. I first consider Craver’s account of this distinction in his book on the nature of mechanisms, and explain some problems. I then offer a novel account of the distinction that appeals to some resources from Mackie’s theory of causation. I end by explaining how this account enables us to better understand what mechanisms are and their various features.

**1. Introduction**

The notion of a mechanism has become increasingly important in philosophical analyses of the sciences. Many philosophers now accept that explanations that appeal to mechanisms have a fundamental role to play in scientific practice (Bechtel and Richardson 1993; Glennan 1996; Machamer, Darden and Craver 2000). The notion of a mechanism, however, still remains inadequately understood. There is unclarity about what precisely makes something count as the mechanism for a capacity, and no agreement about the criteria we should use in making this determination. One way this problem has become apparent is that we still lack a clear account of how to define the difference between the relevant and the irrelevant parts a mechanism contains. We recognize that there is a difference between the parts that are relevant and those that are not, but we lack an adequate account of how this works.

 In this paper, I will examine this issue and offer an answer to this particular problem. My concern will be to explain how we should understand the difference between the relevant and irrelevant parts of a mechanism, and the criteria we should use in making this distinction. The paper will be organized in the following way. In Section 2, I will explain how the problem of relevance arises in trying to understand mechanisms and why this issue is important in the sciences. In Section 3, I will examine Craver’s (2007) recent attempt to address this issue in his book on the nature of mechanisms. Section 4 will show that while the account he offers represents one of the first attempts to address this issue at length in the literature, the problem is that it only provides an account of evidence for relevance and not relevance itself. In Section 5, I will present a novel account of relevance which makes use of Mackie’s discussion of causation and *inus* conditions, and explain how the account improves over the previous account. Finally, in Section 6, I will draw some conclusions about the account and its role in helping us to better understand mechanisms in the sciences.

**2. The Problem of Constitutive Relevance**

There are a number of concerns researchers in the sciences have in attempting to understand the phenomena in their domain. These include such things as discovering whether there are general laws that apply to the phenomena in question, what kinds of predictions can be made, how the phenomena can be best explained, and so forth. These are issues that arise in many forms of scientific research. But in addition to these concerns we also find that many researchers are interested in understanding the makeup of structures and how they are capable of performing various capacities. For instance, researchers on human vision in psychology are interested in understanding how the capacity for color discrimination depends on the eye’s structure. The human eye consists of numerous parts that are involved in producing this sort of capacity (the lens, retinal receptors, vitreous humor, etc.). Understanding the capacity of color discrimination and how it is performed by the eye requires an understanding of the parts of the structure, and their operations. In this way researchers become interested in understanding the mechanisms that serve to underlie this capacity. In many sciences like biology, neuroscience, and psychology there is a keen interest among researchers in investigating the details of such mechanisms and how they operate to produce the phenomenon of interest.

 As commonly understood, a mechanism is a structure or system that performs some capacity. This can be understood as a particular behavior or activity a mechanism performs.[[2]](#footnote-3) Take the capacity of color discrimination performed by the eye as our example. Researchers have learned that (as far as the processes in the eye are concerned) information from light in the environment is passed through the pupil and impacts the retinal receptors in the posterior of the eye (i.e., rods and cones). The retinal receptors contain different kinds of rhodopsin molecules that are chemically structured to interact with the light. The interaction of the light with the rhodopsin molecules causes a photoreaction in the receptor cells, which leads to a neural signal that is sent through the optic nerve in the back of the eye. After leaving the eye the neural signal is relayed to the appropriate parts of the brain for further processing. The capacity for color discrimination is something researchers on perception want to understand. Explaining how the capacity is performed leads researchers to be interested in the parts of the eye that make this capacity possible.

 In attempting to understand a mechanism like this researchers confront a difficulty, though. The human eye is a mechanism that contains many parts that contribute to other capacities in addition to color discrimination, such as brightness discrimination, distance perception, motion detection, etc. It is understood that not every part or component of the eye is involved in each of the capacities that are performed. It is known, for example, that the basic system for light reception in the human eye consists of the rod and cone receptors and their photopigments in the retina, since these are what are needed for transducing the information from light in the environment into neural signals. But understanding how the eye acquires the information from light does not require understanding the focusing system within the eye (e.g., the lens system). This is because the focusing system is really responsible for *adjusting* the information about the light present in the eye, and not for the mere acquisition of such information (cf. Bock and von Wahlert 1965, 122).

 There is, unfortunately, no agreement how to go about distinguishing the relevant from the irrelevant parts in a mechanism like this. We recognize that there is an intuitive distinction to make among the parts a mechanism contains, but we have only a poor understanding of how to explain this. The problem has been recently noted in Craver’s book (*Explaining the Brain* (2007)) in the course of his discussion of explanation in the neurosciences. He says that the problem of explaining what makes a part of a mechanism relevant to a capacity the mechanism performs (what he calls “constitutive relevance”) has been largely neglected by philosophers in this area.

The failure to address constitutive relevance is a major lacuna not just in Cummins’s model of explanation, but also in the systems tradition generally, in recent discussions of mechanistic explanation . . . and, in fact, in all discussions of “microreduction” in the philosophy of biology and the philosophy of mind. Considerable philosophical effort has been expended on the topic of etiological (that is, causal) relevance, but almost none has been dedicated to the problem of constitutive relevance. (140)

Although a lot has been written about the nature of mechanisms and their role in scientific explanations, it is surprising that we still lack an acceptable answer to this basic problem.

 There are several reasons why an answer to this problem would be important to have. First, having an account of relevance would help us to better understand mechanisms in general. The task researchers have is one of explaining how various mechanisms perform the capacities researchers are interested in. Yet, we have only a poor understanding of how this works if the most we can say is that “the behavior is due to the underlying mechanism in some manner or other.” Ideally, what is wanted is a detailed account of how the different capacities of a system depend on the specific parts present. Answering this question is, thus, an important part of understanding what is involved in giving a mechanistic explanation. Second, this issue is related to other, well-known issues about reductionism and interlevel relations in the sciences that have received a lot of attention. One issue is the familiar idea that there need not be a one-to-one relation between kinds of mechanisms and kinds of capacities because of the occurrence of multiple realization. The same capacity for color discrimination may be realized one way in a particular individual, say, and in a different way in another individual. This possibility is thought to have important consequences for issues about reductionism in the sciences since it would mean there is cross-classification between kinds at different theoretical levels, and so no way of reducing them to one another (see Fodor 1974; Kitcher 1984; Kim 1992; Bechtel and Mundale 1999). Presumably, deciding whether this is the case requires an understanding of when the mechanisms considered belong to the same kind or not, and, so, requires we have criteria for individuating mechanisms and their parts. This means that classical problems about reductionism and related concerns depend on a clear understanding of this prior issue. It is to be expected, then, that addressing this problem will contribute towards answering other, fundamental questions about the sciences.

**3. Craver’s Account of Relevance**

This is the problem of relevance we need an answer for. It will help to consider the problem by describing how one might approach the issue to begin with. In explaining a capacity of a mechanism, researchers are concerned with understanding the details of how the mechanism operates. This requires determining the various conditions under which a capacity is exhibited by the system. In that case, a natural thought to have is that researchers should begin by describing the capacity they want to explain, and then look for the parts within the mechanism that are involved in bringing about the capacity. The relevant parts will be the ones involved in bringing about the capacity, and the irrelevant parts are not so involved.

 In fact, I think a careful reading of Cummins’ work suggests that he has a similar account of relevance in mind, despite what Craver says before about the systems tradition saying little about this problem. If one looks at his writings, Cummins is careful to explain that the relevant parts of a structure are those which are involved in giving what he refers to as a “functional analysis” (see 1975, 196, n25). The idea is that a part is relevant just in case it is involved in providing a functional-analytical explanation of the presence of a capacity.[[3]](#footnote-4) So it would be wrong to think that the systems tradition has not said anything about this issue. While I think this is important to observe, I do think Craver is right that this issue is of fundamental importance and that it has not generally received the attention it deserves (for some others who have discussed this issue see Shapiro (2004) and Couch (2009)).[[4]](#footnote-5) I also think that the remarks Cummins makes on this point are somewhat vague until we understand precisely how to define the notion of relevance and what this involves. In particular, we need to know what it means for a part to “figure in” providing an explanation of a capacity on the account. One of the virtues of Craver’s book is that it helps clarify the issue by examining it in more detail than is common. I want to develop our consideration of this issue by looking at the account Craver provides.

 The account offered in the book is along the lines of the suggestion just made, only it is more carefully detailed and nuanced. He says we should think of the task of explaining the performance of a behavior or activity (he prefers these notions) in terms of what he calls giving a “mechanistic explanation” (2007, 7). Suppose someone is interested in an activity and wants to learn how it depends on the parts of the mechanism that has it (note that Craver’s account also permits one might begin with a given part of a mechanism first, and then later attempt to discover what activity it performs through investigation). The activity is specified in terms of the behavior the mechanism performs, which is typically described by means of verbs. For example, we have seen that one activity of the eye is the activity of color discrimination that involves transducing information from light into neural signals that proceed through the back of the eye. Once researchers have specified this activity, they then seek to identify the particular activities of the parts of the eye that bring the activity about. In this case, the activity of color discrimination will be explained in terms of the activity of the pupil to let the light in, the activity of the photoreceptors to interact with the light on the retina, the activity of the rhodopsin molecules in the receptors to undergo a conformational change in response, etc. The idea is to identify the subactivities that are involved in the perceptual processes within the eye, and to identify the parts with the activities. These are the individual physical parts of the mechanism (the pupil, the receptors, visual pigments) just mentioned. In short, the idea is to decompose the mechanism into the activities and parts involved in explaining why the overall activity of color discrimination occurs. As Craver says, the explanation of an activity *F* of a mechanism *S* proceeds by identifying the subactivities [*C1, C2, . . . Cm*] and the parts [*P1, P2, . . . Pn*] which have them, and how they are organized to enable the mechanism to perform activity *F* (2007, 7). The organization of the parts within the mechanism is an important element of the explanation, since not any arrangement (temporal, spatial, etc.) of the parts will bring about the activity. So in a complete explanation this is a feature that has to be included in the account.

 In Craver’s view it is the organization of parts and their activities that together account for the overall activity in question. This complex structure serves as what he calls the “mechanism” for *F* (where the mechanism is distinct from the overall structure itself). In this sense, a mechanism can be understood as a proper part of a structure and serves as what some would call the realization basis for an activity. When we have completed identifying this mechanism and made clear how it accounts for the activity, we have given what Craver calls a constitutive, or mechanistic, explanation (2007, 108).

 Now, I noted that not all of the parts of a structure are relevant to each activity it performs, since some parts do not play a role in bringing about a given activity. These would include waste products, say, that float through the inner eye that do not contribute towards the process of color discrimination. These kinds of features Craver calls mere “parts,” and distinguishes them from what are termed “components” (which genuinely contribute to the activity). The question to be answered is how we determine which parts of the structure serve as the relevant components, and which are mere parts.

 To answer this question Craver appeals to the manipulability account of causation, which has been developed in another context by Woodward (1997, 2003). The idea is to appeal to a view about the nature of causation and causal relevance, and show how this can be extended to the notion of mechanistic explanation. The view Craver presents is that researchers can determine whether a part is relevant to an activity by establishing that they are mutually manipulable. The ability to manipulate a part of a structure to bring about changes in its behavior is evidence the part is relevant to the behavior the structure performs. As he explains, “a part is a component in a mechanism if one can change the behavior of the mechanism as a whole by intervening to change the component *and* one can change the behavior of the component by intervening to change the behavior of the mechanism as a whole” (2007, 141). Put in general terms, the idea is a part *X* is relevant to some activity *Y* if interventions on *X* bring about changes in *Y*, and vice versa (the manipulability relation in question is symmetrical). We can illustrate the account in the following way. Suppose researchers are interested in showing the pupil is a part relevant to the activity of the eye to control for brightness from light in the environment—this concerns the amount of light permitted to fall on the retina. The way researchers can demonstrate this is by showing that there is a mutual manipulability relation between the pupil and the activity in question. To do this, researchers might first try to bring about changes in the pupil by introducing the chemical Cyclogyl into the eye which impairs the pupil’s ability to operate (this is a chemical used in eye exams to dilate the pupil and facilitate retinal examination). They would then examine whether this brings about changes in the eye’s behavior of brightness discrimination. On the other hand, researchers might next try to bring about changes in the behavior of brightness discrimination by blocking the light entering the eye directly. They would then observe whether this has an affect on the pupil’s behavior. If intervening on the eye in these ways brings about the expected changes, then researchers can say the pupil is relevant to the activity being considered. However, if the interventions do not bring about the changes, then the part does not make a contribution, and is irrelevant to the mechanism. It may be that the part is relevant to the performance of some other activity of the structure, but, insofar as it does not contribute to the specific activity being explained, it does not have a place in the mechanism for that activity.

 Craver makes some further points about the details of the account worth noting. In particular he claims that the interventions have to meet certain conditions to be appropriate. He says the kinds of changes that matter are what he terms “ideal interventions” (2007, 154). Roughly, this sort of intervention occurs when we can show that the change in the behavior of the activity *is due solely to the change in the component*, and not because of other interactions with features of the mechanisms. This condition is required to rule out certain indirect relationships that can be confused with relevance, but which should be excluded. The interventions researchers make must bring about the changes to the activity by means of the component, but not, for example, by directly affecting the activity itself. Craver notes that the various requirements on what makes an intervention ideal fit together with the experimental procedures that are actually used by researchers in understanding how mechanisms work. Researchers in the sciences commonly seek to manipulate mechanisms experimentally in order to identify the relations among the parts and the activities present. This includes performing various types of interference experiments, stimulation experiments, and others Craver describes (2007, 146). Each of these forms of investigation helps researchers in understanding how the parts of a mechanism are related to the activities researchers are interested in, and a complete statement of the account will be sensitive to these further points.[[5]](#footnote-6)

**4. A Difficulty**

While this account is an improvement in understanding mechanisms, there is a difficulty with the account of relevance. In describing how a part of a mechanism is relevant to an activity, we have been told that it is facts about manipulability that are important. It is these facts that enable researchers to determine whether a part of a mechanism is relevant to an activity or not. It is important to observe that Craver frequently describes the account in terms of the methods researchers have for establishing whether a part is relevant. In one place in the book, for example, he discusses how one can manipulate sodium channels to alter the membrane potential of a neural cell, and he says that “the ability to manipulate items in this way is crucial *evidence* for establishing causal and explanatory relationships among the mechanism’s components” (2007, 132; italics added). In another place, he describes how the activities of the parts (the X’s) in a mechanism (S) can be determined to be relevant to the mechanism’s overall activity being explained. He writes, “I conjecture that to *establish* that X’s *φ*-ing is relevant to S’s *ψ*-ing it is sufficient that one be able to manipulate S’s *ψ*-ing by intervening to change X’s *φ*-ing . . .” (2007, 159; italics added). The language used here concerns the methods researchers have for establishing whether a part is relevant to an activity.

 But this way of describing the point makes it seem epistemic; that what we are being offered is a way of *deciding* whether a part is relevant to an activity. This is an important aspect of understanding the relationship between parts and activities, and, as such, has a role to play in understanding the issues. But this is different from telling us what the relevance relation is. The relation we are concerned with is a relation in the world between the parts of a mechanism and an activity it performs. To provide an account of the relation I take it one needs to explain what this relevance relation consists in. On the account offered, we are told we can determine if a part *X* is relevant to an activity *Y* by seeing whether interventions on *X* bring about changes in *Y*, and vice versa. It is by observing whether the changes in the part bring about changes in the activity that we can establish the part is relevant or not. Learning this is information of sorts about the part involved. But it is not the same as providing an account of the relevance relation itself which holds between the part and the activity. So insofar as the account is merely concerned with how to establish a part is relevant it seems we are left seeking something more. The account provided does not explain what the relevance relation is independently of the evidence researchers have for manipulating the parts of a mechanism.[[6]](#footnote-7)

 It is worth noting that there is a similar worry that has been raised about the account Woodward offered in his discussion of causation. Early on a complaint was made that an account of causal relations in terms of possible manipulations confuses epistemological issues with the nature of the relations themselves. Glennan, for example, is someone who has complained that the account really addresses the epistemic issue of how one goes about identifying when causes and effects are appropriately related. He writes that “the manipulability theorist has made an important point about the epistemology of causation. . . . Experimental manipulations can provide evidence *that* variables are connected, even in the absence of mechanical knowledge of *how* they are connected” (2009, 318; for related worries see Psillos 2007). It should be noted, in fairness, that Woodward has replied to this worry about his account (2004, 204), and denied that it should be understood in this way. But regardless how this issue affects Woodward’s view, it would be mistaken to interpret Craver’s account in this way. The language he uses is epistemic and there is no indication in the book that he intends the account to be understood in other terms.[[7]](#footnote-8)

 There is an additional piece of evidence to support this way of thinking about the account. In giving his account Craver tells us that it offers a sufficient (but not necessary) condition for relevance. This is an important feature to understand. If the mutual manipulability account only provides us with a sufficient condition for relevance, this would suggest that there are kinds of relevance not covered by the account, and that there is something more to say about the relation. In that case it seems fair to wonder what more there is to the notion that has not been explained (the account offered later will attempt to give both sufficient and necessary conditions for relevance). In making this point I should note I am not suggesting that the account provided isn’t useful in certain ways, or that it doesn’t supply us with information that can be used to supplement an account of relevance. Understanding how one can go about establishing that a part is relevant to an activity would be something important to have learned. But it does suggest that there is more to understand about the relation than we have been given.

 Let me respond to a concern someone might have with this way of understanding the account. It might be suggested that Craver is only concerned with scientific explanation, and so he doesn’t have to worry about this issue. While there is something to this idea, I don’t think it is correct to say he is only concerned in the book with scientific explanation. It is true that he spends a good deal of time focusing on this issue, but it seems to me the account offered overlaps with metaphysical issues in certain ways. For instance, notice he says explicitly that the argument he offers relies on the thesis of multiple realizability, and he invokes realization and supervenience relations in various places. These are commonly understood as metaphysical relations and not simply matters of scientific explanation. He also contrasts his account with Kim’s and Gillett’s accounts of realization that are metaphysical. If Craver’s account is intended to be a genuine alternative to these accounts, then it is hard to understand how it cannot have something to say about these and related relations like relevance. So even if it is said the account is focused on scientific explanation this does not mean these issues are as removed as may be suggested.

**5. Another Account of Relevance**

I now want to offer an alternative that goes beyond the account presented and which doesn’t have this problem. To approach the account, we can begin by recalling how providing a mechanistic explanation is supposed to work in the terms Cummins uses. The idea is that researchers explain the presence of a capacity by identifying the mechanism that realizes the capacity. For a structure, this will consist of a set of components and their organization that underlie the occurrence of the capacity. In this respect the issue concerns identifying the components of the structure that are involved in determining the capacity’s occurrence. The fact that the components serve to determine the presence of the capacity is why they have to be appealed to in giving the explanation.

 When we consider a particular structure we have seen that there may be numerous parts present that are not all involved in the capacity’s occurrence. We saw that researchers have learned that the waste products in the human eye are not involved in the basic capacity for color discrimination, while the retinal receptors are important components. This means there is a distinction between those parts in the eye that do not determine the presence of color discrimination, and those that do serve to determine the capacity. Those parts whose absence does not affect the presence of the capacity are not needed, and can be ignored in giving the explanation. So what we are looking for is an account that enables researchers to distinguish the necessary parts from the ones that are unnecessary.

 This way of describing the issue brings to mind a notion familiar from discussions of causation. I think we can usefully appeal in this setting to the notion of an *inus* condition from Mackie (1974). Mackie is primarily concerned with explaining the nature of causal relations in terms of necessary and sufficient conditions. He offers us the following example to explain the account. Suppose that an electrical circuit in a house short-circuits and causes a fire, and the house burns down. The short circuit caused the fire to occur in conjunction with a variety of other conditions present. These include the short circuit, oxygen, and combustible material. Each of these is an individual condition that is part of a complex condition that caused the fire to occur on the particular occasion. Without each condition present, the short circuit wouldn’t have led to the fire (e.g., without oxygen present, the fire would not have started). Mackie suggests that we can think of the total cause of the fire as a complex condition made of the individual conditions that are needed for bringing the fire about. In light of this, when we say that the short circuit caused the fire, for Mackie, what we are saying is that the short circuit was a necessary condition for the fire to occur on the occasion. In this sense, the short circuit is an *insufficient but nonredundant part of an unnecessary but sufficient* condition for the fire (i.e., an *inus* condition).

 Notice this account allows that a fire can be started in different ways on different occasions since there can be different causes of a fire. It is permitted that in another house the fire may have been caused by a lantern tipping over instead. In this case, the lantern will be the cause of the fire together with the presence of the other conditions of oxygen, combustible material, etc. In this situation as well, the conditions involved will be *inus* conditions for the fire.

 I think we can say something very similar about the relevant components of a mechanism. We said a mechanism consists of several components and their organization that together serve to determine the presence of the capacity. The components are perceived as parts of a complex structure that serves to realize the capacity’s presence. And, in a similar way, the individual components of the mechanism will be necessary for the presence of the capacity on an occasion since each component has to be present. What this suggests is that the components of a mechanism that realize a capacity should be seen as *inus* components. They are the relevant parts of a structure that researchers should appeal to in giving the explanation. I propose to define a relevant part, then, as *an insufficient but nonredundant part of an unnecessary but sufficient* mechanism that serves as the realization of some capacity. Under normal conditions the retinal receptors are necessary for the processing of information from light in the human eye on an occasion. The processing of information will not occur without the receptors being present, and so the receptors should be seen as *inus* components.

 To make this more precise the situation can be described in the following way. Suppose we have a complex structure *ABCD* that serves to realize a capacity *F*. Suppose, further, that, of the parts present, only *ABC* are needed for the presence of *F* on the occasion, and the other part *D* is an extra part that serves no role in the presence of the capacity. In this case, the individual components *A*, *B*, *C*, are *inus* components for the capacity *F*, and *D* is an irrelevant part that should be ignored in giving the explanation. This is because the latter part plays no role in explaining why the capacity is present. Furthermore, it should be apparent from this that the complex structure that consists of *ABC* together with its organization serves as the mechanism for *F*.

 To avoid misunderstandings and deal with potential difficulties, there are several clarifications it will help to make about the account. First, it should be clear there is a difference between Mackie’s account and the use I am making of it. As I noted, his concern was with explaining the nature of causal relations between events. Now, it is commonly believed that events that are causally related are metaphysically distinct from one another. We know that by flipping the light switch one can cause the lights to come on, and that the event of the lights coming on is a distinct event from the flipping of the switch. But the situation is different with respect to mechanisms and their capacities. In this case, the presence of a mechanism is thought to necessitate the presence of a capacity in a sense stronger than causal necessitation (cf. Levine 2001, 14). This is because the presence of the mechanism is thought to metaphysically ensure that the capacity is present. The relation between them should, therefore, not be viewed as a causal one. There is also support for this point from the fact that the effect of a cause is typically believed to occur *after* the cause (the lights coming on occur after the flipping of the switch). In the case of a mechanism, though, the capacity is thought to be present at the same time the mechanism that realizes it is present. So the *inus* notion I am using needs to be understood in a different way from the account Mackie offered.

 Second, it may seem that the account doesn’t fit well with common ways of describing the relation between mechanisms and capacities. It is often said that a mechanism should be sufficient for the realization of a capacity, but should not be considered necessary. This is related to concerns about multiple realization. If different kinds of mechanisms can realize the same kind of capacity, then no mechanism can be necessary. But this is not something the account intends to deny. The account accepts that the mechanisms that realize a capacity are sufficient (in the sense of realization) for the presence of a capacity; it is merely the components of the mechanisms that are necessary in the circumstances for the capacity to occur. The present approach accepts common ways of viewing the realization relation, and adds the *inus* notion to the account to improve our understanding of the mechanisms.[[8]](#footnote-9)

 The third point is that it is important to be clear about the notion of “in the circumstances” used in the account. Mackie makes a distinction it is important to be mindful of (1974, 31). He suggests there are different ways of thinking about the notion and only one is right for understanding the account. When we speak about a particular event causing another event in the circumstances, in one sense we might be referring to the broad circumstances in which the causal sequence occurred. For instance, suppose someone flips a switch and causes the lights to come on in a particular room. The lights coming on will have been caused by someone flipping the switch, but we accept that the same (token) effect could also have been produced by the person introducing a current in the wires going to the light directly. In this way of talking, the cause of the effect might have been different in the circumstances. But Mackie makes it clear that this is not the appropriate sense he thinks is right for understanding (token) causal relations. He suggests that a statement about the flipped switch causing the lights to come on should be understood to mean that, on the particular occasion in which the lights in fact came on, they were caused by the flipping of the switch. In this case, it is the sequence of events which took place that serves as the circumstances to consider. In this sense, the flipping of the switch was necessary for the lights coming on. This is because the flipping of the switch played a noneliminable role in the sequence of events that occurred. We should understand the sense in which a component is necessary in the circumstances for a capacity in a similar way.

 When this point is understood we can deal with a common concern raised about accounts like those I am presenting. This concerns the problem of redundant parts. Suppose it is claimed that one of the kidneys of a person is a component in a mechanism that realizes a particular quantity of blood filtering done by that kidney, and so is *inus* for filtering blood. The person also has a second kidney that (in addition to its own work) can perform the same job if there is a problem with the first one. In that case, it seems false to say that the first kidney is necessary in the circumstances for the blood filtering. We have already addressed this concern in our previous remarks. The sense in which the kidney is necessary in the circumstances concerns the particular occasion in which the blood filtering occurred in the individual. Understood this way, the kidney (as it was used) *was* necessary for the occurrence of blood filtering on the occasion, and so this should not be seen as a problem.

 The next point to note is that the account presented does not make any commitment to Mackie’s views beyond the notions I considered. There is no commitment, in particular, to the explanation of the general notion of necessity he offered. What is needed for the account to work is that there be some account of this latter notion that is consistent with the account I presented. Mackie himself is explicit that the utility of the *inus* notion does not depend on the details of his account (1965, 44). There is more to be said about how the account offered can be developed to address concerns about the notion of necessity and its analysis. A detailed review of this issue is beyond the scope of this paper, but it is worth noting it is merely required that there be some account of this latter notion that fits with the account offered. It is also worth noting in relation to this that Mackie’s views on the notion of necessity have been extended and refined in more recent work. Strevens (2007), for example, has suggested ways Mackie’s views on this issue can be revised to improve our understanding of causation. While I think appealing to this work is one line of development worth considering, I would allow there may be other ways of doing this as well consistent with my account. The concern I have had is how the *inus* notion can be used in understanding relevance, and not with giving a full account of these other issues.[[9]](#footnote-10)

 The final point to observe is just that the account provides an explanation of what the relevance relation is, and not of the evidence we have for it. This relation is distinct from whatever evidence we may have about whether the relation obtains on a particular occasion. We may have various ways of discovering that this relation obtains, but these nevertheless remain distinct from the relation itself. So, in this respect, the account goes beyond the manipulability account that was considered before.

**6. Conclusion**

It is commonly suggested that the notion of a mechanism has an important role to play in scientific practice. Many researchers in different fields appeal to mechanisms in explaining the capacities of the phenomena that interest them. This is an important notion in the sciences, and something that philosophers are interested in understanding. Until recently, though, there has been little discussion of what exactly the notion of a mechanism involves and how to identify the components that make them up. The problem we have focused on concerns understanding how the parts of a mechanism are relevant to a capacity it performs. The account presented has attempted to show that there are resources from Mackie’s theory we can appeal to in trying to solve this problem. If the account is on the right track, it will be helpful in clarifying a number of issues about the relation between mechanisms and capacities that have been obscure.

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1. \*I would like to thank Bernie Berofsky, Stuart Glennan, Pete Mandik, Gualtiero Piccinini, Michael Strevens, and an anonymous referee for assistance with this paper. Carl Craver has been especially helpful. [↑](#footnote-ref-2)
2. In my other work I have spoken of capacities and will continue to do so here, although Craver’s preference (2001) is to speak in terms of behaviors or activities rather than capacities. I don’t intend anything significant to depend on this difference in what follows. [↑](#footnote-ref-3)
3. Here is the appropriate text from Cummins. “Indeed, what makes something part of, e.g., the nervous system is that its capacities figure in an analysis of the capacity to respond to external stimuli, coordinate movement, etc. Thus, there is no question that the glial cells are part of the brain, but there is some question whether they are part of the nervous system or merely auxiliary to it.” [↑](#footnote-ref-4)
4. Here is a passage from Shapiro, for example, who talks in terms of identifying the relevant properties of mechanisms rather than parts. “I propose to use the name *R-property* as a label for those properties of realizations whose differences suffice to explain why the realizations of which they are properties count as different in kind. . . . [such properties] are identified in the course of functionally analyzing some capacity. . . . [they are] those properties that causally contribute to the production of the capacity of interest” (Shapiro 2004, 52). [↑](#footnote-ref-5)
5. I should note that Craver’s account of mechanistic explanation is usefully richer than I am describing it. In Chapter 4, he discusses ways that Cummins’ account of functional analysis differs from the full-blooded notion of mechanistic explanation he has in mind, and he discusses several kinds of organization of components that are different from one another. He also discusses several of the criteria on an account of explanatory relevance. These are important details for understanding the features of mechanistic explanations, but I am overlooking them because they do not contribute to the particular difficulty I raise in the following section. [↑](#footnote-ref-6)
6. Notice that Craver describes constitutive relevance as “a relationship between a component in the mechanism and the behavior of a mechanism as a whole” (2007, 146, n26). Understood this way, it is a relationship between a component and the mechanism’s behavior. But when it comes to the account he explains how to ascertain if a component is relevant to the mechanism’s behavior (not the relation), which is something different. [↑](#footnote-ref-7)
7. Let me make two observations about the point being made here. First, Craver has informed me that he intends his account to be understood in epistemic terms (personal communication). Second, there is a possible misunderstanding of the point being made that I want to avoid. It is no part of my project to criticize the manipulationist account of causation presented by Woodward itself. My only concern in this paper is with the relation of constitutive relevance and whether this is adequately explained on Craver’s account. This issue is not the same as how to evaluate competing accounts of causation since I take it constitutive relations are different from causal relations. [↑](#footnote-ref-8)
8. There are two points to note about this. First, in fitting together with common ways of thinking about realization relations the account also serves to improve our understanding of what multiple realization involves. This is because it helps one to understand what the mechanisms are that underlie the capacities. This has been a concern in recent debates, where there has been a lack of agreement about how to identify the mechanisms that should be considered in the examples (Bechtel and Mundale 1999; Bickle 2003; Polger 2008; Aizawa 2009). The account can be seen to have implications for these broader issues. Second, notice that Mackie accepts that the *inus* relation is a symmetrical relation between causes and effects. In the account I am offering this means the realization relation is a nonsymmetric relation, and the relevance relation is symmetrical. So the account is similar in this respect to the view Craver offers. [↑](#footnote-ref-9)
9. One other issue I have not addressed is that Mackie’s account of causation is deterministic. In using his view to characterize the notion of constitutive relevance as I have, this entails that every mechanistic explanation deductively entails its explanandum. This appears to conflict with Craver’s view that mechanistic explanations should not be viewed as arguments that allow inferences (explanations rather are ontic). I am not sure this latter point is right, though I have not discussed the issue in this paper. [↑](#footnote-ref-10)