Causal Learning and Illusions of Control

Synonyms

Contingency learning; Illusions of causality; Superstitious behavior

Definition

Causal learning is the process by which people and animals gradually learn to predict the most probable effect for a given cause and to attribute the most probable cause for the events in their environment. Learning causal relationships between the events in our environment and between our own behavior and those events is critical for survival. From learning what causes fire (so that we could either produce or prevent the occurrence of fire at will) to learning what causes rain, what causes cancer, or what caused that particular silly accident that we had with the car a few days ago, both the history of humankind and our individual history are full of examples in which causal learning is crucial. But, as can be said for other forms of learning as well, causal learning is not free of errors. Systematic biases and errors are known to occur under certain conditions. One of such common biases is the illusion of control. The illusion of control can be defined as the belief that one's behavior is the cause of a desired event that is actually independent of it. Illusions of control are an important factor in the development of superstitions. For instance, the superstitious belief that by dancing one can produce rain, is normally accompanied by the illusion of controlling rain.

Theoretical Background

The origins of research on causal learning can be traced back to the Greek philosopher Aristotle and it has ever since interested philosophers, experimental psychologists, cognitive scientists and, in general, all scientists interested in how humans learn and acquire knowledge. Nowadays, causal learning is generally studied in the experimental psychology tradition and is normally considered to be a central aspect of cognition. However, as it is the confluence of causal learning and the illusion of control research what we are addressing in this entry, it is interesting to note that this general cognitive perspective has not been applied to the study of the illusion of control until very recently. The illusion of control has traditionally been regarded as one of those cases in which the cognitive system fails to work in an adaptive manner. As such, the study of the illusion of control has been more often linked to Clinical, Health, and Social Psychology than to the Cognitive and Learning Sciences. Today, however, the study of the illusion of control is recovering its place as part of the Learning Sciences and is being regarded as the normal consequence of the way the learning system works.

In a typical laboratory experiment on the illusion of control, a given outcome (e.g., getting points in a computer game) is programmed to occur at certain intervals, or according to a predetermined sequence, and the experimental participants are instructed to try to obtain it. The usual result is that, when asked at the end of the experiment about the extent to which they believe to have controlled the outcome, participants normally believe their control to be significantly greater than the value of zero which has been programmed by the experimenter (e.g., Alloy and Abramson 1979). The current use of web-based control for experiments on human learning allows demonstrating that these effects occur not only in the laboratory but also in the more noisy and uncontrolled arena of the Internet. This suggests that the illusion of control is a robust phenomenon that develops easily in natural settings.

Ever since the seminal laboratory studies on the illusion of control, Ellen Langer (1975) showed that the personal implication of the participant was an important factor in producing the illusion. Therefore, a traditional interpretation has been that emotional and motivational factors, such as a need for control and a need to protect self-esteem, were at the basis of the effect. Moreover, an association between the illusion of control and an absence of depression has been repeatedly reported, which has also lead to the suggestion that either the illusion protects from depression, or depression protects from the illusion (Alloy and Abramson 1979; Taylor and Brown 1988). In line with this, the illusion of control has been described as the inverse of the learned helplessness effect that occurs when people realize that desired events are uncontrollable (e.g., Langer 1975; Matute 1996). These findings have also been taken sometimes as supportive of the motivational, self-esteem explanation, though, as we will see, they do not necessarily support this view over the learning approach.
Even though it seems clear that the illusion of control can provide beneficial effects on self-esteem as well as a protection from depression and helplessness, these prophylactic effects, however comfortable they may feel, do not provide an explanation for the illusion. This is so because, in the first place, protection of self-esteem could well be a side effect of the illusion rather than its cause. Secondly, and most important, because the self-esteem hypothesis does not attempt to explain how our cognitive system produces the illusion: it simply postpones the question. Being the illusion of control the product of a learning process (and more specifically, a particular case of causal learning), general learning theories that can account for causal learning can in principle be applied to the illusion of control as well. These include theories of associative learning, connectionist learning, Bayesian learning, or inferential learning. Despite their differential proposals, what is common to all these learning theories is that all of them would assume that the illusion of control is the outcome of a much more general cognitive mechanism. Many theories that explain causal learning as the formation of associations between causes and effects, or as statistical reasoning or even as an inferential process, would agree to predict an illusion of control when both the candidate cause and the to-be-explained effect occur frequently and do coincide frequently by chance. Not surprisingly, these are the conditions where the illusion of control is most often observed.

An important additional prediction of the learning approach is that, if the illusion is the result of a normal process of causal learning, then it should occur regardless of whether the potential cause is the participant’s own behavior or an external cause. This is not what the Social and Clinical Psychology theories of the illusion would predict. According to these latter views, the illusion occurs to protect self-esteem and whenever the potential cause is external there is no need to protect self-esteem. The amount of evidence in the area of learning that shows that causal illusions occur when the potential cause is an external event suggests that personal involvement is not needed to produce these illusions. Personal and motivational factors could perhaps enhance the illusions, but they are not necessary. Both the illusion of causality that occurs when the potential cause is external and the illusion of control that occurs when the potential cause is the participant’s behavior are enhanced under the same conditions that are predicted to be critical by the many theories of causal learning. Indeed, many artificial and machine learning algorithms designed to learn according to the theories of natural learning will necessarily suffer illusions of causality (and of control) when exposed to those conditions. Such conditions are many, but perhaps the most relevant can be summarized as follows: (a) a high frequency of occurrence of a desired uncontrollable outcome (or a low frequency when the outcome is aversive); (b) a high frequency of the potential cause (i.e., our own behavior when we speak of an illusion of control; any other cause when we speak, more generally, of an illusion of causality); and (c) a high number of coincidences of the potential cause and the outcome (Alloy and Abramson 1979; Matute 1996; Matute et al. 2010). It is interesting to note that the high frequency of the potential cause is equivalent with a high personal involvement when the potential cause is the participant’s behavior. It is possibly for this reason that many of those results have often seemed to support the self-esteem explanation.

Important Scientific Research and Open Questions

One of the challenges related to this topic is to find out what the role of personal involvement really is. Does it really increase the illusion? If so, why? How? Is it because our perceptual and learning abilities are modified when we evaluate the efficacy of our own behavior? Could it be that we learn causal relationships in the same way regardless of whether it is our own behavior or an external cause what plays the role of the cue, but that we then make a different judgment as a function of whether the potential cause is our own behavior? Many questions related to these ones are becoming really exciting topics of debate right now. The perception of action, of will, of authorship… How do we attribute a given outcome to our own behavior or to other sources? How do we decide that we are responsible for a certain action? Does this depend on the consequences of the action? These and other related questions concentrate a great deal of the research being conducted at present (and possibly in the following years) on the illusions and perceptions of causality and of personal control.

Another important issue is whether these effects are adaptive and should be promoted, or, by contrast, should be regarded as maladaptive effects to be “corrected” in therapy. This question can be understood in various ways. If we look at the evolution of our species, we must admit that if superstitions and illusions of control have survived up to our days, this necessarily must mean either that they are adaptive on their own right or that they are an innocuous collateral effect of an otherwise adaptive learning process. A possible consequence of the normal functioning of the learning system could be that those potential causes and effects that occur together and become linked during causal learning will, from time to time, turn out to be causally unrelated. This would be a collateral effect of the causal learning system working in a way which will most often be adaptive and correct, but sometimes vulnerable (Matute 1996). In consequence, as we already
noted, many artificial and machine learning algorithms that model learning according to the predictions of current theories of human causal learning do also suffer the illusion. This does not mean that the algorithms are programmed to do so. However, the illusion is a consequence of their causal learning dynamics. As of natural selection, a system that detects causal relations that sometimes result illusory might be more adaptive than an alternative system with such a high threshold for the detection of causal relations that often fails to detect relations that do exist (e.g., McKay and Dennett 2009).

In addition, the illusion of control itself could be adaptive on its own (Langer 1975; Matute 1996; McKay and Dennett 2009; Taylor and Brown 1988). If the illusion makes us remain active in our trying to obtain desired events, such as rain or fire or health, then, whenever we are uncertain about whether a relationship is really causal, it should be adaptive to maintain the illusion that our behavior is being useful so that we persist in trying to obtain the desired outcome. As a source for behavioral persistence, the illusion of control could be at the basis of human change and adaptation. The alternative option, which would consist in realizing that there is no control over important outcomes and that therefore it makes no sense to keep on trying, would produce helplessness, which includes behavioral cessation in addition to depression and other problems. In this sense, it appears that maintaining a high level of activity is possibly an adaptive strategy. Sometimes, however, ceasing dancing for rain, and even going through a transient depression after realizing that we cannot cause rain, can be adaptive too. It could cause our efforts to be redirected so that we can discover better ways to bring water to our land. As we already noted somewhere else (Matute et al. 2010), applying what we know about the illusion of control to reduce the impact of superstition in our society should contribute to a better world. In one way or another, there must be an optimal level of the illusion of control (not too low, not too high) which enhances persistence while still allowing room for change.

Cross-References

Artificial Learning and Machine Learning
Associative Learning
Bayesian Learning
Causal Learning
Connectionist Theories of Learning
Human Causal Learning
Inferential Learning and Reasoning
Learned Helplessness
Web-Based Control for Experiments on Human Learning

References
