**Theory Dependence and Observation**

It is a commonplace that we can test empirical beliefs by observing the relevant part of reality to see whether the belief is true. Experimental science is founded on the same idea: we can check our theories for truth by engaging the appropriate experiments and observing their results. Philosophers have explored whether observation might be influenced by prior theories or mental states in ways that compromise its role as a check on the truth of those beliefs or theories. These discussions take place mainly in two contexts of inquiry: the theory of modularity in psychology, and the theory of confirmation in the philosophy of science. Our entry begins with an overview of ways in which observation might be dependent on theory, and then turns to their potential ramifications for epistemology and the philosophy of science.

**1. Theory-Dependence**

*Dependence of what?*

Two types of perceptual state might be said to depend on the perceiver’s theory: perceptual beliefs, and perceptual experiences. In the classic Müller-Lyer illusion, two lines perceptually look to be of different lengths, even though their length is the same. (To construct an example of the illusion, simply draw two lines parallel to each other, with arrows pointing in on the one and out on the other). Learning that the lines have the same length does not change the way the lines look. The informed perceiver *believes* that the lines have the same length, while *perceiving* them as differing in length. Their perceptual belief thus differs from their perceptual experience.

The term “observation” has diverse uses. When “observation” denotes perceptual experience, then observation is theory-dependent when a prior theory influences the content of the perceptual experience. For instance, it is sometimes said that depression makes things look grey. If this claim is not just a metaphor, but a literally true claim about the impact of mood disorder on brightness perception, then it is a case where a mood, or perhaps a belief to the effect that things are glum, affects how bright objects look to be when you see them. In contrast, when “observation” denotes perceptual *belief*, then observation is theory-dependent when the usual process of forming beliefs by taking a perceptual state at face value is disrupted or otherwise altered by a prior theory. For instance, in the Müller-Lyer case, it is disrupted by the perceiver’s prior theory that the lines are the same length, while the perceptual state itself remains untouched.

Besides perceptual experiences and perceptual beliefs, unconscious or pre-conscious perceptual states could also in principle be influenced by prior theories of the subject. Prior theories could also influence patterns of attention, directing attention toward certain features of a scene and away from other features of it. Gaining perceptual recognitional capacities, for instance, consists in learning to direct attention to distinguishing features of kinds. Standard theories on perceptual learning suggest that one learns to distinguish between kinds of mushrooms or birds that previously looked indistinguishable, by learning which features are distinctive of them and attending to those features.

Since the New Look movement of the mid-20th century and the publication in 1983 of Jerry Fodor’s influential book *The Modularity of Mind*, psychologists have debated the extent to which perceptual processes are insulated from the rest of the cognitive system, in the way that the perception of the Müller-Lyer lines seems insulated from the perceiver’s knowledge that the lines are the same length. Perceptual processes are said to be *modular* when they are free from any such influence. It is generally granted that perceptual belief and some forms of perceptual attention are not modular. Modularists about perception also grant that perceptual modules can develop, but they distinguish between the development of modular processing via learning, and genuine penetration of the modules by non-perceptual cognitive factors. In psychology it is highly controversial whether early stages of perceptual processing such as early vision can be influenced by expectations or beliefs on the part of the perceiver. A challenge for non-modularists is to establish that a given effect is genuinely an effect on perception rather than solely on perceptual belief. For instance, in Bruner and Postman’s classic 1949 experiment involving anomalous playing cards, subjects would report an unexpectedly red six of spades to be a six of hearts. Further evidence is needed to conclude that the effect is on perception itself, to show that things looked to the subject the way they would when seeing a six of hearts.

*Dependence on what?*

In the case of the Müller-Lyer illusion, perceptual belief formation is affected by the perceiver’s antecedent beliefs about the environment. But there is room for impact on perception and perceptual belief formation by other non-perceptual states of the perceiver, such as moods, desires, expectations, racial stereotypes which may not be best understood as beliefs, or physiological states of fatigue. In discussing the ramifications of theory-dependence, we focus primarily on beliefs and expectations.

**2. Ramifications of Theory-Dependence**

There are multiple ways for observation to be affected by theory, and many epistemic roles for observation to play. We distinguish broadly positive from broadly negative impacts of theory on observation, while bracketing debate about whether observation is indeed as central to science as it has been taken to be.

*Positive Ramifications*

Some influences of theory on observation are benign. For instance, one's interests and expectations influence what one attends to, as when a primatologist focuses on a chimp rather than the bars of its cage. In many such cases, attention merely selects a part of the scene to be observed, apparently without corrupting the ability of observations to confirm or disconfirm theory. Relatedly, theoretical sophistication might enable an expert to observe more than a non-expert, as when a radiologist observes an incipient tumor on an X-ray where the non-expert does not. Here expertise improves the ability of the perceiver to detect phenomena, again apparently without threatening the epistemic role of her observations. The question remains open to what extent expertise can open up new vistas. Arguably a perceiver, no matter how expert, could not observe H20 molecules or radiation as such. But it is an open question what principled basis there may be for such a limitation of expertise on observation.

A different benign effect of theory on observation is posited by strongly holist views of rational belief formation. According to these holist views in epistemology, perception is evidentially inert unless supplemented by background beliefs, such as beliefs concerning the reliability of perception. Holists compare observation with scientific instruments. Scientific instruments help scientists properly assess scientific theories, but only if the status of the instrument as reliable is in good standing. According to holists, observation can help confirm or disconfirm hypotheses about the world, but only if one has reason to believe that those observations are reliable. In this way, according to holists, all perceptual beliefs depend for their justification on prior theories.

Holist views set a high bar for observation to play a rational role in testing hypotheses. The bar may be set lower, so that observations can help test hypotheses, even absent further background beliefs that those observations are reliable. But even then, background beliefs might still enhance the degree of support provided by perception for belief.

*Negative Ramifications*

On an extreme skeptical view, one always observes only what one expects to observe. If correct, this view would undermine scientific practice. It suggests that no observation can disconfirm a theory already held by the observer, or rationally resolve disagreement between scientists with competing theories. There is no evidence supporting the extreme view however, and in fact it seems refuted by ordinary examples, such as the lucky recipient of a surprise party who notices the unexpected crowd in her living room, or the surprised perceiver of a black swan who had previously thought all swans are white. One might still think that scientific observations trained by conditioning will be determined by one’s expectations, and thus incapable of playing a confirmatory role. For a counterexample from the history of science to this fallback view, consider the Transit of Venus of 1874, when observations of a partial eclipse of Venus were used to calculate the distance of the sun from the Earth. As the historian Jessica Ratcliff points out in her account of the 19th century transits, observers trained strenuously on specially constructed models to observe a "Black Drop Effect", in which the image of Venus warps and stretches across the face of the sun, and yet mostly failed to observe the “Black Drop Effect” when they observed the transit itself.

Still less extreme hypotheses about perception, if true, leave it vulnerable to influence of prior expectations, potentially blunting one's sensitivity to the environment. In the case of memory color discussed by Hanson et al, subjects classify an achromatic banana as yellow. In an experiment done by Levin et al, subjects match a racially ambiguous face to different positions on a brightness scale in different conditions, depending only on the racial category label written underneath it. When such cases involve illusion and the formation of a mistaken belief about the environment, observation fails to supply knowledge, since knowledge is incompatible with mistaken belief. A further question is whether these phenomena disrupt rational belief, which may survive failures of knowledge (someone might rationally have a mistaken belief when an extensive body of evidence points in a misleading direction). How this question is answered depends on the outcome of a central debate in epistemology concerning whether rational perceptual belief requires an appropriate perceptual sensitivity to the environment. “Internalist” say no, “externalist” views say yes.

Another way in which theory can affect observation is by discrediting it. In everyday life, those in the know about mirages do not revise their beliefs about water in the desert when they see a certain shimmering appearance in the distance. In science, when a student fails to achieve the standard value for the speed of light when replicating a famous experiment, the rational response is not to revise the value for the speed of light, but rather to question whether the experiment was conducted correctly. Here the observation obtained by the student does not disconfirm the particular theory, given the overall network of beliefs of the student. In contrast, other things being equal, the rational response to seeing a black swan is to revise one’s belief that all swans are white, rather than one’s belief that one is seeing a swan. A philosophical task in this area is to give a principled account of when an observation should be discounted and when it shouldn’t.

**Conclusion**

A range of phenomena goes under the heading of “theory-dependent observation”. Even if some observation is dependent on theory, the phenomenon needn’t be an occasion for skeptical despair. It might instead represent conditions for the possibility of confirming theories by observation. Providing a theory of which types of theory dependence of observation would be most troubling and why remains an unfinished project for epistemology.

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See also: epistemology; induction and confirmation; modularity of the mind; Given, Myth of the; prejudice and stereotyping.

**Further Readings**

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