

Aristotle's Induction: Binding the Universal to the Particular

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Aristotle, like many other philosophers, considers the highest aim of philosophy to be theoretical knowledge.¹ Theoretical knowledge gives the cause of a thing in universal terms. Much of Aristotle's writing expounds upon the implications he deduces from universal causes. However, deduction alone is not sufficient to account for knowledge. Aristotle ironically explains that we must learn the universals by induction from particulars.² In the account of induction, however, it becomes clear that we can know a particular thing only insofar as it partakes of the universal. The origin of knowledge presupposes both universals and particulars. Thus Aristotle's account binds inseparably the world of universals and the world of particulars.

In this essay, I examine Aristotle's account of induction of universals from particulars, as we know them through perception. I also piece together some far-flung but important fragments of the account and propose an interpretation of points which Aristotle leaves unclear. Finally, I examine some peculiar effects of the process of induction which Aristotle describes.

The Insufficiency of Deduction

In the *Posterior Analytics*, Aristotle inquires how we learn the universals necessary to form theoretical knowledge. Deduction is not enough in itself because for some things there is no universal cause by which we can understand them. Those things for which there is no cause Aristotle calls "principles." He states: "I call principles in each genus those which it is not possible to prove to be" (*An. Post.* I.10.76a1).

Since principles are usually defined relative to a genus, knowledge which transcends a genus can allow us to deduce the principles of that genus (*An. Post.* I.10.76a1). For example, Newtonian mechanics explains

1. This essay was awarded third prize in the 1995 David H. Yarn Essay Contest.

2. Note that the sense of induction in this paper is not the same as that in Hume's problem of induction. The induction Hume considered was prediction of the course of future events based on observation of past events. Aristotle's induction, not especially concerned with time, is the learning of universal species from consideration of particular examples.

Kepler's principles (laws) of planetary motion. Kepler observed empirically that the planets move in elliptical paths, but he failed to explain why. Newtonian mechanics later explained that the planets move in elliptical paths because they have momentum and are attracted to the sun. However, Newton could not explain why the planets have momentum or why the sun attracts them. We can always ask: where does the higher knowledge, from which we deduce all else, come from? To avoid an infinite regress or circular deduction, we must recognize the existence of first principles—those principles for which there is no higher explanation. Then, if we are to have knowledge of these first principles, we must recognize a source of knowledge of universals other than deduction (*An. Post.* I.3).

Induction, the Beginning of Knowledge

Aristotle concludes that we become familiar with the universal causes in the first place by induction from the particulars.³ We relate to the particulars through perception:

So from perception there comes memory, as we call it, and from memory (when it occurs often in connection with the same thing), experience; for memories that are many in number form a single experience. And from experience, or from the whole universal that has come to rest in the soul (the one apart from the many, whatever is one and the same in all those things), there comes a principle of skill and of understanding—of skill if it deals with how things come about, of understanding if it deals with what is the case. (*An. Post.* II.19.100a3–9)

Thus after perceiving and remembering a number of things, we gain an experience of whatever universal these things have in common. Before experience, the percepts are "undifferentiated" (*An. Post.* II.19.100a16) to the mind: "for though one perceives the particular, perception is of the universal" (100a17). Until the point called "experience," the universal has not stabilized in the soul (100a6). Thus, recognizing the universal is experience.

After several memories accumulate, "a difference comes about" (100a1) so that we distinguish the universal and thenceforth are familiar

3. "There are, therefore, principles from which deduction proceeds, which are not reached by deduction; it is therefore by induction that they are acquired" (*EN* VI.3.1139b29–32).

with it. A universal which the soul differentiates from raw percepts Aristotle calls a "primitive universal" (100a16). Elsewhere, Aristotle uses the word *primitive* to describe the principles, referring to them as "primitive, immediate principles," (99b21) then as "immediates" (99b22). Later he refers to the principles simply as "primitives" (100b5). Thus, I take a primitive universal to be a universal known immediately, without the mediation of any other universal. This is the sense in which the principles are known, for by definition they have no universal explanation or cause. The primitive universal is like a principle because it is deduced from no other universal.

We come to know the primitive universal through induction from several particular percepts. By experiencing other primitive universals in the same genus, we can next distinguish higher universals, for example, by going from the species "man" to the genus "animal" and so forth. Then as animal explains man, once we have induced animal, man is no longer a primitive universal, but animal is. Through many steps of induction we can eventually become familiar with the first principles which admit of no causal explanation (*An.Post.* II.19.99b16–18, 100b10–12).

However, the account of *Posterior Analytics* II.19 is incomplete. It does not specify how it is that "though one perceives the particular, perception is of the universal." It also does not say what allows the soul to differentiate the primitive universal from raw percepts. Furthermore, *Posterior Analytics* II.19 only hints at the standards a set of percepts must meet to support the induction of a universal.

Perception of the Universal

Aristotle's account of perception in *De Anima* sheds some light on how perception is of the universal: "each sense-organ is receptive of the object of perception without its matter" (III.2.425b23). Aristotle describes a particular object as the unity of one or more universals with matter. Without matter, there can be only the universal. Hence, although a particular object causes perception, the object's particularity is stripped away along with the matter in the process of perception. The sense-organ receives only the object's universal characteristics.

However, on Aristotle's account, the universal that enters my eye the first time I see a tree is not a tree, nor even a species of tree, such as aspen.⁴ If it were, then the need for memory and experience in induction

4. Indeed, most trees I see (excepting very young sprouts) are far too large to fit inside my eyes.

would disappear. What first enters my eye is color. The universals that enter the mind most immediately through the senses Aristotle calls the special-objects of sense:

I call special-object whatever cannot be perceived by another sense, and about which it is impossible to be deceived; e.g. sight has color, hearing sound, and taste flavour, while touch has many varieties of object [including roughness and smoothness, heat and cold]. But at any rate each judges about these, and is not deceived as to the fact that there is colour or sound, but rather as to what or where the coloured thing is or as to what or where the object which sounds is. (*De An.* II.6.418a11–15)

I can see the color brown, but I cannot see the object, the tree. For most objects of perception the essence is not the special-object of any sense. Hence, usually the object of perception is perceived only incidentally.⁵ I do not see the tree as tree but rather the tree as brown. Indeed, while I do not yet recognize the universal "tree," I do not recognize brown color or other special-objects as being qualities of any particular substance. I must accumulate experience before I can infer from the colors, textures, and other special-objects that I perceive the universal "aspen" of which the special-objects are qualities. Still, other objects can share the aspen's color, so the color is a universal. Because the special-objects of the senses are universals, perception is of the universal.

However, we have yet to see how one can move from perception of special-objects to induction of another universal, such as the tree. The special-objects of sensation do not seem to be the primitive universal in Aristotle's outline of induction:

when one of the undifferentiated things makes a stand [becomes intelligible or recognizable], there is a primitive universal in the mind . . . ; again a stand is made in these, until what has no parts and is universal stands—e.g. such-and-such an animal stands, until animal does, and in this a stand is made in the same way. (*An. Post.* II.19.100a15–16)

The expression "makes a stand" appears to refer to the formation from memory of an experience. This is the basic step of induction. The first

5. "An object of perception is spoken of as incidental, e.g., if the white thing were the son of Diares; for you perceive this incidentally, since what you perceive is incidental to the white thing. Hence too you are not affected by the object of perception as such [but rather by the object of perception as white]" (418a209–23).

universal we induce from raw percepts is a primitive universal. In our example of the tree, the primitive universal would be "such-and-such a tree," perhaps "aspen." To explain the induction of the primitive universal we must examine the standards which a set of percepts must meet in order to support the induction of a universal.

Preconditions of Induction

Posterior Analytics specifies that for a set of perceptions to ground induction, they must have something in common. The principle induced from them is that which they have in common (100a4,7). The reason why induction requires several perceptions is related to Aristotle's notion of definition. Aristotle notes that "he who defines must not invent a word (for it would be unknown), but the established words are common to each of a number of things; these then must apply to something besides the thing defined" (*Met.* VII.15.1040a10–13). Similarly, as Aristotle states, in the case of Platonic Ideas, "an Idea which cannot be predicated of more subjects than one . . . is not thought possible—every Idea is thought to be capable of being shared" (1040a25–27). It seems that the need for multiple perceptions to ground induction springs precisely from the character of universals which are applicable to many subjects. Thus, many subjects exemplifying a universal must contribute to the induction of that universal.

As well as having something in common, the perceptions grounding induction must contrast with each other:

As a circle may exist in bronze or stone or wood, it seems plain that these, the bronze or the stone, are no part of the essence of the circle, since it is found apart from them. Of things which are not seen apart, . . . it is hard to effect this severance in thought. (*Met.* VII.11.1036a31–1036b3)

Thus, to induce the circle as a universal form, independent of any type of matter, one must perceive it in a contrasting number of materials. If all the circles we ever saw were bronze, it would be difficult to think of a circle as separate from bronze. Likewise, to induce a genus such as tree we must see more kinds of trees than aspens. Because induction requires contrast in percepts, the multiplicity of senses greatly aids induction:

One might ask for what purpose we have several senses and not one only. Is it perhaps in order that the common-objects which accompany the special-objects, e.g. movement, magnitude, and number, may be less likely to escape our notice? For if there were

sight alone, and this was of white, they would be more likely to escape our notice and all things would seem to be the same because colour and magnitude invariably accompany each other. (*De An.* III.1.425b4–9)

Here, Aristotle identifies certain universals which the soul can induce from perceiving the same object through different senses. These are called the common-objects of sense. Since the special-objects of the five senses for the most part are not the essences of the objects of perception, it is vital that we infer the common-objects from the contrasting combination of special-object percepts. In the same way, the contrast between various perceptions of other universals allows us to single them out.

Understanding the roles of commonality and contrast among the perceptions which ground induction, we can better imagine how the soul induces the primitive universal from the special-objects of perception and the genus from several species. Comparison in the mind of several percepts or several universals clarifies the independent nature of the universal they have in common. We might imagine that the differences cancel each other out, leaving behind only the common universal "that has come to rest in the soul (the one apart from the many, whatever is one and the same in all those things)" (*An. Post.* II.19.100a6–8).

Consequences of Induction

Aristotle articulates piecemeal a sophisticated account of induction as a process of comparison/contrast. The account of induction fills a critical place in a philosophy concerned with universal knowledge. However, the process of comparison/contrast produces universals of a controversial character.

Some effects of the process of comparison appear in *Metaphysics* VII.12. Here Aristotle develops a method for defining species by genus and differentia:

But it is also necessary in division to take the differentia of the differentia . . . we must divide [that which is endowed with feet] into cloven-footed or not-cloven; for these are differentiae in the foot; cloven-footedness is a form of footedness. And we always want to go on so till we come to the species that contain no differences. And then there will be as many kinds of foot as there are differentiae, and the kinds of animals endowed with feet will be equal in number to the differentiae. If then this is so, clearly the last differentia will be the substance of the thing and its definition,

since it is not right to state the same things more than once. (*Met.* VII.12.1038a9–10,16–20)

This method sounds like a reverse reconstruction of induction through comparison/contrast. To come to know footedness, we see feet of various shapes and sizes, and eventually induce the general notion of a limb on which an animal stands. Aristotle then re-divides footed animals into species according to types of feet. He decides the definition of each species according to the species' relations to other species. The *Topics* likewise endorses definition by comparison.

However, definitions made by comparison clash with important intuitions about essence when "a definition is a phrase signifying a thing's essence" (*Top.* 5.101b36). For example, if man were the only two-footed animal, then "featherless biped" would be a redundant definition, and so "two-footed animal" would be the essence of man. However, man's unique talents of rationality and laughter seem more essential to humanity than two-footedness.⁶ Likewise, to define man as "rational animal" is to make laughter and two-footedness nonessential. Aristotle's method of definition seems determined primarily by accidental relations to other things, not by the essence of the thing to be defined. This definition by relation undermines the distinction between essence and accident fundamental to Aristotle's account of essence. Definition by relation further puts universals, which are supposedly eternal (*EN* VI.3.1139b19–25), in danger of alteration through comparison with previously unknown species.

Definition by comparison also leads Aristotle to conclude that the good for any thing is the end which is unique to it. For he considers the good for a thing to be the fulfillment of its essence, and he considers the essence to be that which is unique to a thing. In this way Aristotle concludes that the good for man is philosophical contemplation, since it is the activity most unique to man (*EN* X.7.1178a5–7). Again, to see the good for man as that which is unique to man seems to overlook many of man's important qualities and desires. Man has many unique qualities, any one of which distinguishes him from other animals. No one of these unique qualities seems sufficient to be the absolute standard of happiness. Nor does any combination suffice, for in fact happiness includes things which other animals also enjoy, such as health.

Aristotle draws his notions of essence and of the good for a thing from the inductive process of comparison/contrast. These notions are

6. Professor Dan Graham pointed out to me the crucial human capacity to laugh.

very important in his philosophy and are ever after extremely influential in philosophical thought. The problems which the process of induction causes for them, then, are grave. Nevertheless, it seems difficult to define things other than by comparison/contrast in a world where we induce universals by comparison/contrast. Despite its problems, Aristotle recognizes that this is the only sensible way to construct definitions. We can recognize things only in comparison with other things.

As we saw in the account of perception, we can know particular objects only insofar as they partake of the universal. Theoretical explanation further depends on knowledge of universals. The particular, then, is unintelligible without the universal. By deriving the universal through induction from particular objects, Aristotle makes our access to universals in turn depend on our experience of particulars. In his scheme, neither universals nor particulars make sense without each other. Thus Aristotle's account of the origin of knowledge binds inseparably the world of universals and the world of particulars.

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