What Can Be Learned from Regress Arguments

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1. What is a regress argument

Regress arguments are about as old as philosophy; they appear historically in the fifth century BCE with Zeno of Elea, and Zeno's bisection and Achilles paradoxes, which purport to show the impossibility of motion, are probably still the best known regress arguments. This is unfortunate, because Zeno's paradoxes of motion have often been misunderstood and underappreciated, and this has tended to give regress arguments a bad name. In fact, at their best these arguments are far from nursery puzzles. They are one of the most powerful devices in the entire philosopnhical toolkit.

The best regress arguments resemble the logical paradoxes, in that they manage to derive highly implausible conclusions from plausible premises. When this happens, the solutions are usually constrained: there are few sensible solutions, and all of them involve giving up something plausible. Usually in philosophy, things are not so constrained, and alternative positions or theories tend to proliferate; so a good regress argument can help to put philosophy on more solid ground.

A regress argument involves a situation in which one thing leads to another: a first entity or event somehow requires second entity or event, and this requires a third, and so forth. The series never ends, and under certain circumstances this can be puzzling. It's easier to see how this works by looking at a specific example: let's begin with two of Zeno's paradoxes.

2. Zeno's paradoxes

Example 1: Zeno's bisection paradox.

This paradox is Due to Zeno of Elea, 490–430 BCE. Suppose that someone, X, needs to move from point A_0 to point B. To do that, X needs to move to the midpoint between A_0 and B: call this point A_1. Then X needs to move from A_1 to B. Now, to get from A_1 to B, X needs to move to the midpoint between A_1 and B: call this point A_2.

This series repeats: for each point X reaches, X needs to pass the midpoint of the remaining a distance to the goal. Thus, the argument generates an infinite series of points, $A_1, A_2, A_3, \ldots$ and X must pass through each of these points.[1] To a modern reader—and here, this means a reader who knows something about the account of motion that derives from Galileo and that culminates in the Nineteenth Century theory of the continuum—the solution to the problem posed by this regress seems straightforward.[2] There is indeed

[1] In this version, the bisection approaches the endpoint of the motion, concluding that X can never reach the goal. A mirror version invokes a series that approaches the initial point, and concludes that X can never get started. Authorities differ on which version the earliest accounts of Zeno are reporting.

[2] This has led some writers to dismiss Zeno's paradoxes as outdated puzzles that have been swept away

an infinite series of points for X to traverse, but this is not a problem since there is an infinite series of times available for the traversal. In fact, X's motion can be described by a continuous function mapping times to points.

This is one way to solve the puzzle posed by a regress—to simply accept the series that it generates. Another sort of solution, not available in the case of the bisection, is to reject the argument that generates the infinite series.

I don't want to leave the impression that Zeno was one of those philosophers who produed obviously bad arguments. The bisection regress is a correct and useful argument, if it is taken as a refutation of the hypothesis that space is continuous and time is discrete. The continuity of space ensures the existence of the midpoints in the regress, and if time is discrete X must eventually have to occupy a point without a time at which to do so, which is impossible. I believe that the other three paradoxes of motion that are traditionally ascribed to Zeno are devoted to the three remaining cases: (2) space is discrete, time is continuous, (3) both space and time are discrete, (4) both space and time are continuous.[3]

If this is right, the true force of Zeno's arguments against motion can only be appreciated if all four of them are considered together. And the arguments still have foundational importance for theories of space and time, particularly in connection with contemporary attempts to reconcile quantum theory with general theory and gravitation. They provide powerful reasons for dismissing two cases: the one in which time is continuous but space is quantized, and the one in which time is quantized and space is continuous. (Zeno provides arguments for the other two cases of course, but these are not regress arguments, and there may be ways of getting around them.)

3. A biological regress

Commonsense biology tells us that species reproduce themselves: when whitetail deer reproduce, for instance, the result is another whitetail, not a spotted from or a grey squirrel or even a mule deer. There must be a reason for this, and the only alternative seems to be that the parents somehow contain a pattern for their species, and that this pattern is instantiated when reproduction occurs.

When this pattern is passed on to the next generation, it must be complete, otherwise the offspring would be incomplete. But the offspring are able to reproduce, so the pattern must contain a pattern for producing the next generation.

Now, there are two kinds of patterns. A pattern for a circle is itself a circle, but the pattern for a house isn't a house, but a set of drawings of a house. Suppose that reproductive patterns are of the first kind. Then the pattern of a human, for instance, will be a human. Therefore each human capable of reproducing will contain patterns of its descendents, which themselves will be humans, and so some of these will contain patterns which themselves

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by modern kinematics and the mathematics of continuity. It's no problem at all that X has to traverse infinitely many points to get from A_1 to B. This is because there are infinitely many times available for X to do the job.

[3] See [2].

will be humans. If reproduction can occur indefinitely, then, some humans will contain an infinite series of patterns, each of which is itself a human.

This is called the *preformation* theory of reproduction, and the little patterns or prototypes are called *homunculi*. Like the continuous solution to the bisection regress, this theory accepts the infinite series that is created by the regress argument. Our second example is the resulting regress.

Example 2: A regress of homunculi.

To reproduce its species, a human must contain a smaller human, which itself must contain a smaller human, and so on *ad infinitum*.

This theory is tenable, even if in some ways it's implausible, as long as physical nature is homogenous with respect to spatial scale. It is the power of imagination that makes scalar homogeneity plausible. If we imagine ourselves getting smaller, it's natural to imagine ourselves in circumstances more or less like the ones in which we find ourselves. The only difference would be the relative sizes of ourselves and, say, insects. There is no reason to imagine basic differences in the natural order, simply because of change of scale.

But we know this is wrong. Animals, for instance, are made up out of cells and eventually out of organic molecules. But below a certain scale of magnitude, cells and organic molecules are impossible. This in itself rules out the preformation theory of reproduction; we can't accept an infinite series of smaller and smaller animal prototypes.

So we have to ask ourselves where the argument for the preformation theory went wrong. Well, the preformation theory of genetics assumes that the pattern for a deer must itself be a deer. There is an argument for this assumption: A deer couldn't grow from a drawing or a description of a deer, but a large deer can grow from a small deer. Moreover, to make a cake, say, from a recipe you need a cook to execute the instructions, as well as ingredients. But in the process of reproduction there is nothing like a cook. The problem, then, is to provide a mechanism for turning a recipe for an organism into an embryo of the same species. Molecular genetics provides the solution to this difficulty.

In 1953 the pattern was shown to be encoded in the molecular structure of DNA. This "genetic code" is not an organism, but a description of an organism in a chemical "language." The reproductive mechanism is therefore not growth, but is more like craftsmanship without a craftsman. At this point, the problem of describing the mechanism becomes acute. It took about 13 years of intense research after the discovery of DNA to work this out. Through complex biochemical mechanisms, DNA regulates processes of protein synthesis that construct an organism conformin to the genetic pattern.

Molecular biology therefore enables a solution to the genetic regress that stops the series at the first step; parents contain patterns for their offspring, but this pattern is not itself an organism.

4. Cognitive regresses

Philosophers are still inventing regress arguments, over 2500 years after Zeno. Many of the most important and illuminating of these have to do with cognition. In this abbreviated version of the paper, I'll consider just one of these.

Example 2: A regress of reasons.

In [1], Lewis Carroll begins with the following argument from Euclid:

(A) Things that are equal to the same are equal to each other.

(B) The two sides of this triangle are things that are equal to the same.

(Z) Therefore, the two sides of this triangle are equal to each other.

This argument is valid—that is, the conclusion (Z) follows from the premises (A) and (B). But, says Carroll, to actually infer the conclusion, you must accept not only the premises of the inference, but the validity of a second argument:

(C) The argument from (A) and (B) to (Z) is valid.

Carroll seems to have a point here: if you didn't accept (C), you wouldn't be able to infer (Z) from (A) and (B), so the additional premise seems to be needed. But this process repeats: to infer (Z) from (A), (B) and (C), you need to accept the proposition that this argument is valid, and so on *ad infinitum*. It looks, then, as if any this, and in fact any inference will have to require infinitely many premises.

We have seen that in general, there are two ways to deal with a regress problem: (1) accept the infinite series, (2) stop the process that precipitates the series. Actually, both of these solutions are appropriate for Carroll's paradox, depending on how "must accept" is interpreted.

If acceptance here is a matter of logical consequence or validity, then we can accept the infinite regress: the original argument from (A), (B) to (Z) is valid, as are the arguments from (A), (B), and (C) to (Z) and from (A), (B), (C) and (D) to (Z). The series that is generated here is rather trivial, because adding a premise—any premise—to a valid argument will produce a valid argument. The extra premises are not part of the justification of the original argument, and adding them merely produces another valid, and perhaps less interesting argument.

But if acceptance is something that a reasoner *does*, a cognitive act that is performed in the process of reasoning, we can't accept this infinite series. Each cognitive act must take an amount of time greater than some minimum quantum; so if infinitely many acts were required to draw a conclusion, it would be impossible for anyone to reason to conclusions. So this reasoning regress must stop at some point. But how can it stop?

Well, when we reason we can always pause to ask for the justification of a reasoning step we are about to make, just as we can think about the footing on the path we are following before taking a step. But also (and most usually), we simply put our foot down unreflectively and without attending to whether it's entirely safe. And much the same happens with reasoning; we can take a reasoning step unreflectively and without attending to the justification. The regress argument shows that steps of this kind must happen, if there is to be reasoning at all. This, of course, doesn't mean that these steps have no justification. If we have learned good reasoning habits, these steps may well be reliable and would hold up under examination.

This regress can be generalized from deductive reasoning to any sort of rule-following. I won't go into the details here, except to mention that a distinction that Alan Turing makes in [3] is relevant to solving the regress. In discussing Argument 8, he says:

> By "rules of conduct" I mean precepts such as "Stop if you see red lights," on which one can act, and of which one can be conscious. By "laws of behaviour" I mean laws of nature as applied to a man's body such as "if you pinch him he will squeak.

We can clearly see the difference between the two kinds of rules in the operation of digital computers. Laws of behavior are built into the circuitry, and provide the underlying processes that support more complex reasoning. A high-level reasoning routine that a computer is performing might require it to find reasons for many of its inferences. But the underlying reasoning processes that support such activities are built in.

Carroll's regress shows that human reasoning—or for that matter, the reasoning of any intelligent creature—must in this respect, at least, be like that of a computer.

Cognitive regresses go back at least as far as Plato's *Meno*. I hope the one example I've supplied shows that these arguments, if they are well deployed can be remarkably instructive in philosophical psychology. I hope in a longer work to discuss many more examples and do something closer to full justice to this point.

Bibliography

[1] Lewis Carroll. What the tortoise said to Achilles. *Mind*, 4(14):278–280, 1895.

[2] G.E.L. Owen. Zeno and the mathematicians. *Proceedings of the Aristotelian Society*, 58:199–222, 1957.

[3] Alan M. Turing. Computing machinery and intelligence. *Mind*, 59(236):433–460, 1950.