Zeno
PHIL301
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(Evaluating Parmenides)

The One, again

- Does the *One* make any sense whatsoever?
- Note that we do think of reality as “gapless”. That is, even “empty space” is *something* rather than *nothing*: we distinguish between an empty space and no space at all. This makes our ordinary view consistent with Parmenides’ notions of monism and, perhaps, a plenum. (We can think of an empty space as becoming “filled” with some material object; but if space itself is “real”, it is not clear that this constitutes an *addition* to what is. And if there is no adding to reality, then it is a plenum.)
- Is our world homogenous? It seems obviously not. But this appearance is a function of our conceptual division of the world around us. If this division of the world is *arbitrary*, then it is not so clear that any one region of reality does differ from any other. And even if our concepts are not arbitrary, as the reasoning above concerning the plenum suggests, it is not clear that they mark any significance difference in *being*. Bunnies are not barn owls; but both are *beings*, and in that respect they differ not at all.
- The relationship between reality-as-such and reality-as-perceived has been problematic since Hesiod and before. Indeed, arguably, this is a problem intrinsic to human experience. But the reality-perception divide is now become radical: where water (Thales) and change (Heraclitus) are familiar and perhaps thus plausible ontological principles, Parmenides’ *One* seems largely foreign to ordinary human experience and understanding.

Zeno’s Paradoxes

- Zeno was a pupil of Parmenides, and advanced a number of arguments to show that plurality and motion are illusions. They must be, on his account, because the concepts are incoherent. So either reality is incoherent (which the good rationalist Zeno rejects), or change is unreal.
- Zeno advances five “paradoxes” in support of Parmenides, one designed to show that there can be no plurality, and four designed to show that motion cannot be real. These are:
    - The Plurality
    - The Dichotomy
    - The Achilles
    - The Arrow
    - The Stadium

Dichotomy, Achilles, and Plurality

- These paradoxes are related by Zeno's understanding of infinite series.
- In the Dichotomy, Zeno argues that a runner cannot move from point A to point B because in order to do so s/he must first reach the mid-point (fragment 6/A25). This problem is essentially the same as the Achilles, concerning whether Achilles can catch up with a slower runner (7/A26). Here is one reconstruction of Zeno's reasoning:
    1. In order to move from point A to point B, a runner must perform an infinite number of Z-runs in a finite period of time.
    2. But is it not possible to perform an infinite number of Z-runs (or any time-consuming task) in a finite period of time.
        - Here, the reasoning seems to be that an infinite series of non-zero magnitudes sum to an infinite magnitude.
    3. Therefore, the runner cannot move from A to B.
- The Plurality paradox is based on a similar understanding of infinite sums.
- Some of this argument has been lost, unfortunately – see fragments 3/B2 and 4/B1. Zeno evidently intends to argue that the assumption of a plurality entails that all things have either no or infinite size. Here is a reconstruction of his reasoning:

    If there is more than one thing, then all such things are either "so small as not to have size" or "so large as to be unlimited." (4/B1)

    1. If there is more than one thing, then for a given thing *x* either *x* has size or not.
    2. Suppose *x* has size.
    3. Then *x* has parts $\{p_1 \ldots p_n\}$, one of which, p_n, is "in front".
    4. Since p_n also has size, p_n will also have parts, one of which is "in front".
    5. And so on, *ad infinitum*.
    6. Hence, if *x* has size, then *x* is infinitely large.
    7. [Presumably, the only way to halt the expansion is to reach a sizeless part. But then *x* will be composed of things having no size, and will hence itself lack size.]
    8. QED
- It is well known, however, today, that Zeno is mistaken about the nature of infinite sums. It is not the case that every infinite sum of non-zero quantities is itself an infinite quantity.
    - In particular, the following sequence is an infinite sum whose total is 1:
    - 1/2 + 1/4 + 1/8 + 1/16 + … + 1/2n
- This defect defeats the Plurality paradox, evidently. Does it defeat the Dichotomy?
- Try this one on for size: "Ours is a reluctant genie. He shrinks from the thought of reaching 1. In fact, being a rational genie, he shows his repugnance against reaching 1 by shrinking so that the ratio of his height at any point to his height at the beginning of the race is always equal to the ratio of the unrun portion of the course to the whole course. He is full grown at 0, half-shrunk at 1⁄2, only 1/8 of him is left at 7/8, etc. His instructions are to continue in this way and to disappear at 1. Clearly, now, he occupied every point to the left of 1 (I can tell you exactly when and how tall he was at that point), but he did not occupy 1 (if he followed

instructions, there was nothing left of him at 1). Of course, if we must say that he vanished at a point, it must be at 1 that we must say that he vanished, but in this case, there is no temptation whatever to say that he occupied 1. He couldn't have. There wasn't enough left of him." (Paul Benacerraf, "Tasks, Super-tasks, and the Modern Eleatics")

- Zeno may well be mistaken that the problem in the Dichotomy concerns the period of time required to complete infinitely many Z-runs. However, a different problem may beset the concept of motion.

The Logic of Supertasks

- A supertask is a task which includes infinitely many sub-tasks. One supertask is the motion from A to B, conceived as the series of Z-runs.
- Consider another supertask: Thomson's lamp: a lamp switch turns off the lamp if pressed when the lamp is on, and turns on the lamp if pressed when the lamp is off. Suppose one were to press the switch an infinite number of times (say, once at ½ second, again ¼ second later, etc.). Question, at the completion of the supertask, is the lamp on or off? Since the lamp has only two states – on or off – it must be in either state. But there is no final member in the supertask sequence, so the lamp is neither on nor off.
- Applying this reasoning to the motion from A to B, consider the sequence of Z-runs. We do not wish to assume that the runner gets to B, and strictly speaking, the Z-run series does not include point B; so let us consider only what happens when the whole Z-series is completed.
    1. Having completed the Z-series, our runner is not at B.
    2. If the runner is not at B, then s/he must be to the left of B.
    3. But the runner cannot be to the left of B, since this implies that the Z-series is not yet complete.
    4. Therefore, the runner cannot complete the Z-series (because the assumption that s/he can yields a contradiction).
- Is that argument sound?