

## Halfway Through Space to the Limits of Language by Vernon Burn

A coiled rattlesnake thrashed its tail as the two men rode past.

“Ayh teyll you, this cunny better be good. Real fuckin’ good,” Mungo was saying for the umpteenth time. His horse neighed and nodded for emphasis.

He went on, “But ayh don’t in heyll know why they’d have this bordello in the middle of the stinkin’ desert. All ahm sayin’ is that fer yer sake, this better be the best goddam pussy ah ever did taste. Or there’ll be a reckonin’.”

The threat of violence was ever present and real with Mungo. He used it like other people used small talk and pleasant conversation. For him it was just another form of communication, an effective one. But even that smallish brain in that large, vicious body of his was starting to sense something was amiss, especially when the desert started to really heat up a few miles back.

With faked irritation, Jim said, “How many times do I have to tell you? This fuckin’ place is at a crossroads between the gold mines and the cities yonder. It’s in the middle of the fuckin’ desert, a’cause it has to be. You saw the train line they started buildin’, you numbnuts.” The dry throated voice he said it in was real enough.

Angered, as he so easily was, Mungo replied in a quiet way, bubbling with threat, “You better watch your goddamn words with me. Ah’ll smash yer head.” He punctuated this by spitting out a brown shot of sticky phlegm.

Jim acted a credible mix of apologetic and sullen, “I didn’t mean nuthin’ by it. I just don’t see why I have to keep tellin’ you what iz when it iz. You ain’t got no reason for disbelievin’.”

Their relationship after running in the same gang for a number of years was such that Jim’s pretence mollified the anger of the brute, who took to muttering under his breath with lots of “goddamns,” “pig’s messes” and “stupid sunsabitches” thrown in about how he was sick and tired of rutting on and beating up the same small town whores night after night. He wanted something better. And he might as well get that before they robbed the place. But while he may have felt something was odd about their quest, he had no clear idea of what exactly. He still thought he held the club of fear over Jim’s head.

There really was a new town with a top-dollar brothel with top-dollar whores

out there in the nowhere, ripe for the picking, but they were far off course for that. Jim figured he had better get on with it fairly soon, so he started to make it look like he was adjusting something on his saddle straps in order to fall a little behind. When he was a few yards back and his savage companion was busy glugging from his near empty canteen, he eased the gun out of its holster to check it was still fully loaded and ready to go. He had made sure of it several times before starting out, but the mental preparation for the last gestures of this charade — a plan that started a week ago on that fateful night — required that he check again. Just to set his mind at ease.

It would not be long now.

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A screeching condor.

Jim took off his hat to squint at it. Just under an hour had passed since they had last spoken. The sun was beating down on them with a spite neither of them had experienced before. There was nothing around them but towers of rock in the distance, vast open space, desolation and heat. So much heat.

A parched Mungo croaked, “Fuck this, fuck you and fuck your stoopid whorehouse! Ayh need shade an’ Horseboy needs shade or weyll both die in this damned oven.” He had called every horse he had ever owned Horseboy.

Jim wanted to take no chances of anyone finding Mungo’s body, so he wanted to do this out in the wide open where no one ever could. Anywhere with shade might be a place where lost people could stop and stumble upon his desiccated remains. It was now or never, so, as soon as Mungo’s tirade was finished, he faked collapsing from his horse with heat exhaustion. He needed Mungo off-horse or there was the risk he could get away. Jim wasn’t that good a shot and didn’t fancy trying to hit a fast moving target, even if it was the size of a mountain.

“What in tarnation? Geddup you sack a shit!” No reaction. “Geddup or ahm gonna whoop yer insides to mush n’ leave you out here for the vultures.” Nothing. “GET THE FUCK UP!”

The tension was killing Jim as he pleaded with God to get the big horrible animal down off of his horse.

As enraged as he was, somewhere in Mungo’s brain the cogs were moving

and he realized that the boss of their gang, whom even he did not want to anger, might be somewhat aggrieved if his young cousin, however many times removed, died in the desert on the way to a whorehouse. A whorehouse he had insisted they rob after Jim had told him about it. Or wait, had it been Jim's idea to go? He couldn't remember. Whatever the case, he figured he'd at least better get down and punch the stupid bastard awake.

As soon as Mungo had climbed down and taken two cuss-filled steps toward him, Jim sprang up, whipped out his gun, but almost dropped it.

"What fuckin' game are you playin' now?" Mungo was momentarily taken aback.

Jim spat out in a wobbling voice, "You're gonna die, you shit-piece!" but then wracked with fear, did nothing. Just looked at his enemy, breathing heavily. Could he do it? Could he commit cold-blooded murder, even if the bastard deserved it? Could he?

Mungo, in the quiet, dangerous voice again, said, "Ahm gettin' tired real quick a this shit."

"I know you raped Sally. I saw it." Jim wiped tears of dry-salt from his face.

Confusion flashed onto Mungo's face, but it soon grew into a smile, turning to outright wheezing laughter.

It was too much. Emotional pain compacted to white-hot anger carried Jim. He pointed the gun, cocked back the hammer and fired.

Sound flew out into space. The horses followed.

Click, click, click, the gun was soon empty.

Mungo, eyes wide, scrambled back clutching around his body, "Sheeyat!" He frantically searched around his torso feeling for the wet patches. There was nothing. He'd missed. The dickshit had missed.

Jim was fucked.

Mungo, from a good eleven yards away and now brandishing a knife, looked at Jim. Jim looked back at Mungo and saw the smile was back on his cruel, ugly maw along with a malevolent light in his eyes. The cat was very much the mouse again.

But something occurred to Jim and he started smiling too. This perplexed and halted Mungo, "Ah don't know what you're smilin' at. You ain't gonna enjoy this."

Jim had realised something profound. He was safe. He must be. All that reading had finally paid off. Looking at Mungo straight in the eyes, he said, "You

stupid, ignorant hoople-head. You ain't never heard of Zeno's paradox, have you?"

Mungo found something in Jim's words and manner so powerful and mysterious that he was now rooted to the spot, unable to move, "Zeno's paradox? What in Gawd's name are you talkin' about?"

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We shall now leave Jim and Mungo, as we step into the disorienting world of Zeno's paradox. Panic not my friends, for in good time we shall return to the ghastly end of the horrific literary conceit I used to set this whole sorry thing up. Before that, however, we shall embark on a journey to explore the logical consistencies of motion through space. Something quite pertinent to our theme.

I'm sure many of us have come across or heard of Zeno's paradoxes before and probably even know one or two of them. The one I will focus on is one of the most well known and is commonly called The Dichotomy. It comes to us primarily through Aristotle, who presents it thusly:

*"Zeno's arguments about motion, which cause so much disquietude to those who try to solve the problems that they present, are four in number. The first asserts the non-existence of motion on the ground that that which is in locomotion must arrive at the half-way stage before it arrives at the goal."* [Physics, Book 6, Part 9]

As, I say, many of us may have stumbled upon this before, nevertheless we shall have a wee little explanation of the bummer just to make sure we are all on the same page. Thankfully our dubious pair, Jim and Mungo, are currently in a perfect position to help us in our explication.

In the middle of the searing desert, they have, if we recall, roughly eleven yards' space between them. Now, I don't know about you, but I am a European man of modern predilections, which means I feel nonplussed and fearful when anything is not metric. Eleven yards is roughly equal to ten metres and frankly I would be far more favourably inclined to use such civilised numbers and units of measurement.

Righty-ho then, so they are ten metres apart and Mungo is rather pissed off with Jim after he tried to shoot him. I suspect he'd quite like to get over there and cut

Jim, who is now stunned and on his knees after missing the swine with all his bullets, into a grim and gory flesh-pile. Of course, first he has to travel the distance of ten metres through the intervening space. Now according to old Zeno, when we look at it, this is more difficult than we expect. Actually, we are led to believe that he would say it is an absurd impossibility [*Hugget - plato.stanford.edu, Dowden - iep.utm.edu*].

For argument's sake, let's suppose that Mungo has no worries about Jim running off; Jim is in a mixture of frozen shock and delusional confidence, and so is going nowhere. Besides, despite his size, Mungo can shift his-big-self when need be and is surprisingly a much faster runner than Jim (but that would lead us into a different, if very similar, paradox of Zeno's called The Achilles— for now let's keep things straight and relatively simple with The Dichotomy). Mungo is taking his sweet time about things, really eking out the suspense, by moving at a roughly constant one metre per second. According to Zeno's Paradox, however, even though he is constantly moving toward Jim, he will never actually reach him. This is because he has to travel half the space in the direction of Jim, 5 metres, taking 5 seconds. He then has to go to the next halfway point from there, which is a farther 2.5 metres in 2.5 seconds. Then half of the remainder again, 1.25 metres in 1.25 seconds.

So we can see the basic pattern here. A half, then a half, another half, then yet another half of that, and so on. The sequence looking something like the following [*Grimes - Numberphile, Kelleher - TED-Ed*]:

$$1/2 + 1/4 + 1/8 + 1/16 + 1/32... ..$$

Zeno, so we are led to believe through Aristotle, concludes that it would be impossible to travel the actual distance, because reiterated half divisions end up growing to an infinite distance over infinite time that can never reach the endpoint. In fact, if we take this supposition to its next logical step, one can conclude that we cannot travel any distance through any amount of space at all. If you just consider the distance it would take for one of Mungo's legs to reach the other mid-stride, the same problem arises and his left leg can never reach the point where it is next to his right, and vice versa [*Dowden - iep.utm.edu*]. It doesn't even have to be half the distance either; it could be 99.9% of the distance and time, or 0.000... ..001% of the distance. Dear God, what madness!

Of course, our everyday experience proves this theory wrong. We can move through space. No need to “*soil yer panties*”. Not yet. Indeed it’s quite possible that Zeno didn’t mean his conclusion quite as we take it. Zeno was of the school formed by another Greek philosopher type, Parmenides, and as such had a certain philosophical agenda. Parmenides was all about the whole of reality being unified and solid, there being actually no change in the world, all change being essentially an illusion [*Russell - Chap 5*]. I will not get into a deep discussion about the ideas and sweaty man-love of Parmenides here, except to mention it in the sense that it is from this school of thought — there being no change possible — that Zeno seems to be making his argument that there is something inherently absurd about our concepts of motion [*Dowden - iep.utm.edu*]. Actually, after the discovery of a recently uncovered fragment of parchment,<sup>1</sup> contemporary scholarship posits that it may all have been a joke he came up with when drunk to prove that he had “...an infinite cock, of which no Greek can push to the base!”

So what precisely is it about Zeno’s paradox that causes “so much disquietude” in those who over the ages since Aristotle have tried to sit down and wrestle with the bastard? The first thing is, again, it is apparent from our everyday experiences of standing up and walking to the freezer to get an ice cream that we can see there is something at odds between what he is saying and reality. The second thing, though, is that his argument is very clever and seems understandable to the degree that it presents us with a bit of a head scratcher; how is it we can travel all those half distances through space and time and actually end up anywhere? It was only at the beginning of the last century that mathematicians came up with an answer that they could almost all be satisfied with. To really understand their answer to this conundrum we have to look at two questions: what is a real number, and what is infinity?

So, what is a “real” number? There are several different types of number and to explain this it will help us to remember back to our maths classes at school and the difference between the sets of natural numbers, integers, rational numbers and then finally real numbers.

Natural numbers are your everyday usual numbers starting from 1 (or

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<sup>1</sup> The veracity of the existence of such a parchment is yet to be verified by anyone, anywhere and is in fact completely fictitious.

sometimes from 0) and then adding another 1 to get 2, then add 1 again,  $2 + 1 = 3$ , and then adding one again and again and again, continuously, we get the entirety of the natural numbers all the way to infinity. Then we have the integers, which includes all of the natural numbers to positive infinity, but also goes backwards, so also contains all the negative numbers to negative infinity:  $-\infty \dots -3, -2, -1, 0, 1, 2, 3 \dots +\infty$ .

A step up in total size (but not cardinality) is the set of rational numbers, which includes all the integers. These are also, as the name suggests, all the ratios, and also all the possible fractions and finite or recurring decimals possible which start off like this:  $-\infty \dots -1/3, -1/2, -2/1, -1/1, 0, 1/1, 2/1, 1/2, 1/3 \dots +\infty$ .<sup>2</sup>

In Zeno's paradox we are dealing with recursive fractions of fractions, and hence rational numbers, but to get a more intuitive feel of the issue we need to go one more step to what are called Real Numbers. Let's get real!

Right. To define one of these bad boys is a little bit more complex, but not prohibitively so. First off, we have to stop thinking about numbers at this stage as being separate, clearly defined entities floating out in number space. The real number line is just that: a line, a continuum [*Shillito - ITHM*]. It fills in all the "emptiness" between the rational numbers. When we look at any real number, say for example  $\pi$  (pi), we can consider it to be a conceptual point at the given resolution we choose to look at it. What I mean by that is that a number will always have particular neighbours at a given "magnification", yet we can always zoom in to a finer resolution and see that it actually has closer numbers living next door. No matter how precisely we focus our picture, we can always go deeper into the number line and find new, closer neighbours. For example, at the resolution of  $1 \times 10^{-3}$ , when we look at  $\pi$  and its immediate neighbourhood on the number line it looks like this: 3.140, 3.141, 3.142. When we zoom in a factor of ten, it becomes 3.1414, 3.1415, 3.1416. Another factor of ten and it becomes 3.14158, 3.14159, 3.14160. We can keep doing this ad nauseam.<sup>3</sup> Any real number, therefore, can never be unequivocally expressed or written out in an intelligible sense — except where they

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<sup>2</sup> For a very good explanation of why we use the particular order we do when counting up or down the rational numbers, and other concepts more generally regarding infinity, please visit this page that explains Georg Cantor's work on infinity very nicely:

<http://gizmodo.com/5809689/a-brief-introduction-to-infinity>.

<sup>3</sup> At the last count some egg-head had done this to 8 quadrillion digits [Karrels].

match up to integers or rational numbers — as they are the tip of an infinite dive into the continuum.

Well, now that I have just slapped down the phrase, “tip of an infinite dive into the continuum” on the table, it might be an idea to get a bit more of a grip on infinity and then try and see how all this applies with mathematical satisfaction to Zeno’s little mess.

From its Latin roots and in conventional use the term “infinite” means “that without end, unbounded” [*dictionary.com*].

Fair enough.

The natural numbers, the integers and the rational numbers all extend to infinity and can be counted without end. The real numbers are infinite too, but are also an infinitely larger infinity than the others,<sup>4</sup> such that they cannot be counted. If we can dive infinitely toward numbers in the real number line and never reach a limit on which we can place a foothold and start from, how could we even begin to count them?

A man called Georg Cantor proved we can’t [*Wilkins - gizmodo.com*]. In fact, if you take the number space between any two numbers, say between 0 and 10, it would be equally impossible to count all of the real numbers that exist between them, because, even though we have partitioned the continuum and given an upper and lower limit to the set we are dealing with, all of those “tips of infinite dives” are still completely uncountable.

All of which brings us nicely back to our friend Zeno’s paradox and Mungo’s slow stalk toward Jim, which started from 10 metres away. As we have already seen, between the numbers 0 and 10 there is an uncountable infinity of numbers.<sup>5</sup>

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<sup>4</sup> I refer you again to the Cantor article mentioned above in footnote 2.

<sup>5</sup> This is all very conceptual at any rate. Just to digress for a moment to state that it would appear to be empirically impossible to confirm something having no end, if it really has no end. Something like traveling through unending space to find an edge that can never be reached, because it’s not there. Infinity does have pragmatic value, though. We do use the concept in calculus, which is practically applied in multifarious fields, and it often crops up in physics in our understanding of things like black holes. Oh! And in the Casimir effect, which uses the concept of different sizes of infinite quantum vacuum fluctuations to create a small pressure force proving that empty SPACE is not empty at all, but teeming and fizzing with stuff that constantly pops in and out of existence... That previous sentence by itself is



Here lies part of the reason as to why Zeno was wrong: there is an uncountable infinity of numbers between 0 and 10, but all they add up to in total is TEN in the natural numbers, not the infinite time and distance he suggested it would.

Therefore, between 0 and 10 metres, and 0 and 10 seconds, there is an infinite division we can we make, in this case dividing each remaining section in the progression by two. The way Zeno looks at Mungo’s creep toward Jim is as an infinite collapse from 0 to 10, each step forward being half of the previous one, but each step going deeper into the rational part of the real-number line. Each step does, however, move ever closer to the total, or in proper mathematical speak “our series converges to the limit” [*Wikipedia.org*].

Mungo - 0m•-----	x -10m - Jim
5m•-----	"
7.5m•-----	"
8.75m•-----	"
9.375m•----	"
9.6875m•--	"
9.84375m•-	"
...m•	"
<i>Converges to the limit</i> →	x -10m - Jim

Fig 1. (Dealing with distance, but is homologous and concurrent with time).

And there’s the thing. As our series of numbers converge toward 10 metres and 10 seconds, it becomes “arbitrarily close”, to use more maths lingo, such that at infinity there is essentially no mathematical distinction between our series and our limit [*Shillito - ITHM, Azad - betterexplained.com*].

“Aha!” I hear the tight-arses say, “But even if you got to 0.000000... zeros filling every estimated cubic-Planck-length of the universe (that’s a fuck-load of zeros)...

probably a bit obscure, so go to the Scientific American article on the effect referenced at the end [*Reucroft & Swain 1998*] to understand more. And quite whether that “empirically proves” the infinite is debatable, but it certainly suggests that space is really weird. OK then, enough of this insanity. Let’s get back to our problem.

00000005 metres away, you would still not have gone the full distance and in that infinitesimal space there is still an uncountable infinity of numbers to go.”

Well, yes, but at whatever point you stop it's not infinity, because, if you remember, the thing about infinity is that it has no end. There is no stopping. Therefore, from wherever you rest your series will still be able to continue the progression of divisions and get infinitely closer to the limit. Hence, as above, the distinction between it and the limit is ever moving away from us and is ungraspable.

*“But it can never fully reach the end point!”* I hear you cry in disbelieving apoplexy. Well, in some hard sense I suppose some may insist that. Let's suppose for a moment you, they and Zeno have a point. Let's ignore the maths view and say that our infinite collapse toward the goal of travelling 10 metres can be categorically said *not to be equivalent* to reaching the full length, even at infinity. How could that be considered to be the case exactly?

It's locked into the conditions set at the beginning. You are only ever going halfway. Never is there a full-step, so we cannot go the whole hog. How is it that Zeno is wrong then, if we really never can reach the end point? The answer is that Zeno seems to say that we must necessarily reach halfway, then halfway of that, then halfway of that and so on. And he's not wrong. We must. Yet, we've seen the dead end ring road that such a literalist reading takes the pedants. But there is nothing to say that we must necessarily ONLY do this halfway sequence. It is entirely arbitrary that we choose to measure the halfway, 50% version of things. As I said right back at the beginning of this explanation, we could equally choose 75%, or, 0.16163%, or 69% (*69 dude!*), or even (drum roll please!) 100%. In order to complete any journey you must necessarily complete all of it, and to travel any distance  $x$  greater than zero in a straight line you must first travel a lesser distance  $y$ .<sup>6</sup> These are obviously no contradictions, they are tautologies. The meaning of paradox is that it is in some sense true, while at the same time false. Zeno's "paradox" doesn't really have a full-blooded logical contradiction at all; it is a tautology that's been mislabelled and misunderstood.

As Wittgenstein tells us in his *Tractatus Logico-Philosophicus*:

*“4.462 Tautology and contradiction are not pictures of the reality. They present no*

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<sup>6</sup> Disregarding the complications of possible multidimensional space travel and quantum teleportation.

*possible state of affairs. For the one allows every possible state of affairs, the other none. In the tautology the conditions of agreement with the world — the presenting relations — cancel one another, so that it stands in no presenting relation to reality.*

*4.463. ... Tautology leaves to reality the whole infinite logical space; contradiction fills the whole logical space and leaves no point to reality.”*

If you set up the pre-condition that you will only ever measure halfway, then that is exactly what you will do. This is the crux of the thing, I think: Zeno is measuring (and pre-measuring) motion through space. Measurement is always appending words and logical symbols to the world after the fact of perception. If we try to measure before the fact, it becomes a prediction, not a measurement, which can be either validated by experience or refuted. It is as though Zeno took a walk to the park with his friend, turned around and drunkenly exclaimed that what they had done was “necessarily impossible” before collapsing to the ground and vomiting on himself.

The thing about logic (and language generally) is that it is set up to follow its own rules. That is all it has to do. It does not necessarily have to correspond to the world at large. Many of us know the basic logical syllogism, “All men are mortal. Socrates is a man. Therefore, Socrates is mortal.” [Russell - 168] OK. Yet there is also nothing wrong with the syllogism, “All hamplebangers have a skenomic lust for gunting their benems to death. Gertrude is a hamplebanger. Therefore, Gertrude has a skenomic lust for gunting her benems to death.” It makes little sense to us, because there are terms that are not related to our conventional use of English. It does, however, have logical structure and consistency.

Anyway, before I get stuck in the quagmire that is reference and meaning with this unintentional segue, my basic point is that, despite their bio-linguistic genesis and evolution, language and logic do not necessarily always have to be reflected in the empirically accessible world to be accorded a truth value. They have carved out their own dimension, which partially overlays and holds a harmonious relationship with the world, but partially does not. To hold together in the milieu of signs and symbols they have to be consistent within their own rules. And tautologies are completely consistent within themselves. The same goes for Zeno’s paradox, which is true and consistent within the rules of language and logic (when we ignore the maths viewpoint), but we

can easily see when we go somewhere, or make any movement through space at all, that this “logical truth” doesn’t fully overlap with the real world. Zeno is simply playing around with measurement and, by implication, the infinite nature of numbers.

Tautology and contradiction are the signposts that demarcate the outer boundaries of what is possible with language and logic. The “logical space” in between (to bastardize Wittgenstein’s term) is considerable. The recursive nature of language (you can always add an “and” or another conjugation to append more clauses into your sentence, or even just add another sentence) makes it infinite. It can be infinitely nonsensical, while at the same time it holds within it infinite utility. Yet, it can never get a totally firm grip of the perpetually changing reality we experience and which gave birth to it. There is always a slight slippage. As the Zen monk and teacher Shunryu Suzuki tells us, *“As soon as you see something, you already start to intellectualize it. As soon as you intellectualize something, it is no longer what you saw.”* [sfzc.org]

I think I shall trail off there, after that heavy detonation of Zen. If you want to confirm that for yourself, go sit and stare at a wall in a quiet room for a few years.

So there we go. Where does all this leave our feisty scumbags of the desert? Let us rejoin them and see how it all turns rather ugly.

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Mungo had listened with a confused look on his face to Jim’s rambling explanation of this Zino or Zeon’s thing about going halfway. He didn’t really understand. People were always confusing him with words, like they were a magic he couldn’t use. A fear arose in him that he would not even be able to take one step. He took a breath and tried to move his right leg forward. To make sure it would move he grabbed it with both hands and forced it to his will. The movement looked very queer, but he made it. He took that first step. From that point on he knew he was OK.

Jim had smiled as he explained the impossibility of any attempt on Mungo’s part to reach him. He had been almost sure that he was untouchable. There was, however, a nagging doubt that grew with each step forward the hairy muscle-heap took toward him. There was some itch at the back of his hazy mind that he couldn’t quite place his finger on. Suddenly the heat shimmer in his brain stopped for a moment and he saw through the mirage to what was really there. It was a question: if Zeno’s paradox

were true, how on earth had they managed to make it to the middle of the desert?

His knife glinting in the sun, Mungo walked on. Slowly at first, but as he drew nearer he lengthened his stride. Three yards from his quarry he paused. Jim's smile had suddenly dropped and been replaced by a sickly look.

“Wait,” Jim breathed as he raised his hand to halt his assailant. The inside of his mouth was so dry it took him a moment to bring enough moisture back to continue. But what could he say? “I’m... I’m really not gonna like what comes next, am I?”

“No. No you ain’t.”

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With that came the gruesome end of Jim in an act of such gratuitous sexual violence that were I to describe it as it happened, this awful tale of Pyrrhic vengeance and halfway Greeks would never have made it past the nervous censors.

Worry not though, dear friend. I use the term Pyrrhic vengeance for good reason. Mungo got his comeuppance. After expending so much energy and fluid in his frenzy, he staggered back then collapsed from fatigue, heat stroke and heart failure.

Finally, we switch to the present tense and while the haunting Ennio Morricone music plays in the background, the camera shifts to a slowly turning bird's-eye view, floating up and panning out. We can see as our vantage point slowly drifts upward that the place where Mungo has fallen is ironically eleven yards — ten metres — away, exactly where he had started.

A tumbleweed rolls on between them.

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