LOUISA BUFARDECI
10 − 6 = 4

Louisa Bufardeci is not one to be intimidated by complexity. She has recently turned her attention to the mathematical models being developed by theoretical physicists, who are attempting to set down the formula for the universe with string theory. These physicists are aiming to harmonise the general theory of relativity, which accurately describes the effect of gravity on larger bodies, with existing knowledge of the behaviour of atomic and subatomic particles. String theorists suggest that the smallest kind of element from which everything in the universe is comprised is a string-like structure that can vibrate in multiple spatial dimensions. The differences between larger particles are caused by the particular patterns in which the smaller string components vibrate.[1] Stimulated by these propositions about our spatial reality, Bufardeci has used them as inspiration for a new body of work that includes wall drawings and sculptures.

The multiple dimensions in which these strings exist, however, are beyond the limits of our observation and, at this stage, can only be tested in mathematical equations. Theorists need to graft an extra six spatial dimensions onto our existing concept of a four-dimensional universe, otherwise the physical laws we have established get knocked out of balance when combined. Bufardeci's task, then, relates to the gestural interpretation of this revolutionary 'theory of everything' which proposes that there may potentially be inaccessible worlds all around us.

Bufardeci cannot reveal hidden spatial dimensions in her majestic wall drawings, but she can complicate our conventional views, at the same time as making us feel more at home with change.[2] Riffing off unearthly surfaces of higher dimensional Calabi–Yau manifolds[3], Bufardeci's wall drawing *(In a very short space of time through very short times of space) the universe devolves into a string* 2012 presents rhythmically overlapping monochrome streaks suggesting, at once, states of stillness and flux. From her palm-sized braided sculptures *String theories* 2012 — eccentrically fashioned 'friendship bands' that warp and weave in every direction — we can start to sense greater convolutions.

Recognising the potential disorientation, Bufardeci quotes from James Joyce's *Ulysses* (1922) in the title of her wall drawing, which is gleaned from the following passage:

> Stephen closed his eyes to hear his boots crush crackling wrack and shells. You are walking through it howsomever. I am, a stride at a time. A very short space of time through very short times of space. Five, six: the *Nacheinander*. Exactly: and that is the ineluctable modality of the audible. Open your eyes. No Jesus! If I fell over a cliff that beetles o'er his base, fell through the *Nebeneinander* ineluctably! I am getting on nicely in the dark. My ash sword hangs at my side. Tap with it: they do. My two feet in his boots are at the ends of his legs, *Nebeneinander*. Sounds solid: made by the mallet of *Los Demiurgos*. Am I walking into eternity along Sandymount strand? Crush, crack crick, crick.[4]

Bufardeci's forms correspond to this passage in which Stephen Dedalus toys with his interpretation of the senses. In 'a very short space of time through very short times of space', he questions, as he walks: is there a more fundamental reality than what he can hear and see? Where does he end and another begin? What is the nature of time? Is he creating the world around him through his senses? Is there a concealed reality that is more real than the world he perceives? The mesmerising texture of his perception only seems to fuel his uncertainty.

Bufardeci's addition to the title ('the universe devolves into a string') and her 'friendship bands' help to turn our dizziness into a lightly optimistic sense of connectedness and affection. To think of oneself, indeed to think of all reality, as constructed from unimaginable numbers of the most minute strings, folding in spatial dimensions beyond our comprehension, seems easier when we realise this also means we are more the same than we are different. The equation '4 + 6 = 10' — translating as 4 dimensions we can observe + 6 more we cannot yet enter = 10 — is a more palatable and magnificent description of our spatial surrounds when it is expressed through Louisa Bufardeci's poetic feat.[5]

Peter McKay

[1] Shing-Tung Yau and Steve Nadis, *The Shape of Inner Space: String Theory and the Geometry of the Universe's Hidden Dimensions* [Kindle edition], Basic Books, New York, 2010, location 2517 of 8495.

[2] While we cannot draw a picture in anything higher than three dimensions, Pablo Picasso started thinking in four dimensions with his painting *Les Demoiselles d'Avignon* 1907, under the influence of the French mathematician Henri Poincaré. Poincaré's research into non-Euclidean geometry, exploring hyperbolic and elliptic curvature, simultaneity and time, was also an important precursor to Einstein's innovation that light was the universal constant, rather than time. This discovery fused space and time into 'spacetime' — making four spatial dimensions, instead of only three: the Euclidean dimensions of up–down, forward–back, left–right, as well as time. Spacetime could then be rendered in geometric terms, and was seen to warp with motion and the effects of gravity. Arthur I Miller, *Einstein, Picasso: Space, Time, and the Beauty that Causes Havoc*, Basic Books, New York, 2001, pp.2–5.

[3] Calabi–Yau manifolds are mathematical shapes or spaces that describe the geometry of hidden extra dimensions, projections of which can be rendered in 3D computer software.

[4] James Joyce, *Ulysses*, Penguin, London, 1992, p.45. *Nacheinander* means successive in German, while *Nebeneinander* means side-by-side; *Los Demiurgos* means God's mallet.

[5] Yau and Nadis, location 2541 of 8495. The title of this essay refers to geometer Shing-Tung Yau's reworking of the simple equation used by physicist Cumrun Vafa to help describe the place of the six concealed dimensions in a ten-dimensional universe. Vafa's original equation sits at the conclusion of this text.