

THE GEOSPHERICAL STRUCTURE OF FRANK HERBERT'S DUNE

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Abstract This paper presents two connected ideas about Frank Herbert's use of shared and non-specialist geo-spatial assumption in his science fiction novel Dune. The first of these ideas is that the novel's two major theatres of action--the first being the planet Dune itself, and the second being the landscape of the hero's sense of multi-dimensional space-time--are described and made meaningful by specific reference to the forms and common connotations of terrestrial landscape. This system of reference is reinforced by the use of familiar landscape imagery in the description of character and action. The second idea has to do with the fact that even while the novel makes use of the conventional connotations of landscape concepts ('place,' for example) in its description of setting, action and character, it also simultaneously suggests a questioning and a stretching of these conventions. This paper suggests that, in its creation of an imaginable landscape of space-time and in its reconsideration of accepted assumptions about the meaning of place and the structure of physical reality, the novel indicates and encourages a growing popular interest in the implications of contemporary physics.

We turn to geographical images constantly in thinking and in exchanging information; we construct and convey meaning by reference to our common understanding of a shared physical environment. We describe unfamiliar things by reference to the familiar: "her hat looked like a thunder cloud." We describe the abstract by reference to the concrete: "the silence stretched between us like a desert." We describe the indescribable by reference to the known: "The nature of the space-time continuum is like that of a hilly countryside."¹ What we are relying upon in all of these attempts to 'make sense' is an assumed and shared understanding of the nature of the physical world. At the broadest level, this paper is concerned

with the interaction of these popular assumptions about physical reality with popular fiction. Specifically, it is an investigation of the ways in which a well-known work of science fiction, Frank Herbert's Dune, relies upon--and hence reveals--shared geographical knowledge and assumption in its description of character, action and setting, while at the same time, and using images based on this geographical understanding, it reflects and encourages popular interest in a field of scientific study that challenges our understanding of what physical reality actually is.

The difficulties involved in trying to describe the landscape of one place in the context and the language of another are obvious: how do you describe an ocean to a person who measures water by the bucketful? What happens to an arctic adventure in a language which has only one word for snow? How can Frank Herbert describe the dry planet Arrakis and its resident giant sandworms to a reader who has never even seen a sand dune? Herein lies much of the fun and much of the challenge of the creation of heterocosms or fantasy worlds in science fiction. How can fantasy be fantastic and yet describable, alien and yet imaginable? The obvious answer is that Herbert's Arrakis is imaginable because he has imagined it; it is describable because it is not truly alien, and it is not truly alien because it has been imagined, somehow, by reference to a familiar geography. This geographical reference is discernible not only in the construction and depiction of setting, but also, incidentally but just as clearly, in the description of character, emotion and action. In addition, Herbert uses geographical references to provide building blocks for the construction of an imaginable fictional version of one of the more difficult concepts basic to the new physics. In his descriptions of setting, action, character and the complexities of multi-dimensional space-time, therefore, Herbert relies upon his readers' familiarity with a range of traditional landscape images. In this way, the novel has a clearly geospherical structure.

'Geosophy' is a useful word but not a common one. It was coined by the American geographer J.K. Wright in the late 1940s to describe the study of "geographical ideas both true and false held by all manner of people." Geosophy is a field of study which has been defined as bearing the same relationship to geography that historiography does to history "since it deals with the nature and expression of geographical knowledge both past and present, scientific and intuitive: with . . . 'man's sense of terrestrial space'."² It is important to stress that geosophy is concerned with the

geographical knowledge of non-geographers. In talking here of the geospherical structure of a science fiction novel we are talking about common assumptions, not professional concepts, about vague and symbolic meanings, not organised systems of geographical knowledge.

For the purposes of this paper it would be convenient if some physicist had coined a word which could be to physics as geosophy is to geography, for we are also concerned here with the history of commonly held ideas about physics, specifically, with the development of a popular interest in the post-Newtonian universe of relativity, probability and uncertainty. As this investigation of the geospherical structure of *Dune* will suggest, geosophy is playing an important part in the history of popular physics, for as non-specialists begin to grasp the basics of post-Newtonian physics they tend to do so, paradoxical though this is, in terms of familiar three-dimensional geo-spatial images. If it is hard to describe arctic snowstorms in English, it is surely even harder to use our everyday language to describe what Gary Zukav, in his popular book on the "New Physics," calls "phenomena which defy conceptualization and are impossible to visualize."³

One of the most basic assumptions that we make about our physical environment is that it is best organised in terms of places and the connections between places. It is not surprising, therefore, that one of the most difficult aspects of post-Newtonian physics for us to grasp is the way in which it undercuts our conventional place-oriented understanding of reality. The sense of place--the ability to orient and locate oneself within a meaningful environment--is central to the normal human experience of landscape. The absence of a sense of place is frightening. What do we generally associate with place and the ability to locate ourselves in space? Landmarks, perhaps, high places, viewpoints, paths, light, life, vegetation, stars--things we can recognise and that move (if they move at all) in regular patterns, helping us to orient ourselves in terms of place and direction. What do we associate with placelessness and disorientation? Empty spaces, probably, depths, blackness, flatness, coldness, randomness, barrenness, empty skies and unbroken horizons: landscapes which shift and change and give no spatial markers. Typically, place is reassuring; its absence is threatening. Landmarks and places which offer a view of surrounding country are comforting; dark, void-like spaces and wastelands are disturbing. Unfortunately, coming to terms with the implications of modern quantum physics seems in many ways to require an embrace of

the void. Gary Zukav describes the terrors of this action in talking of Einstein's resistance to the implications of the quantum mechanics he had himself helped to develop. To ask why Einstein resisted, Zukav says, is "to stand at the edge of an abyss, still on the solid ground of Newtonian physics, but looking into the void." To confront the issue is "to leap boldly into the new physics"--and, presumably, into space.⁴ If this is possible, it surely requires a radical recasting of our assumptions about the relative values of place and placelessness. Such an adjustment is described, in explicit and traditional place/void images, by the theoretical physicist Heinz R. Pagels in his recent popular book on quantum physics, The Cosmic Code.⁵

Lately I dreamed I was clutching at the face of a rock but it would not hold. Gravel gave way. I grasped for a shrub, but it pulled loose, and in cold terror I fell into the abyss. Suddenly I realized that my fall was relative; there was no bottom and no end. A feeling of pleasure overcame me. I realized that what I embody, the principle of life, cannot be destroyed. It is written into the cosmic code, the order of the universe. As I continued to fall in the dark void, embraced by the vault of the heavens, I sang to the beauty of the stars and made my peace with the darkness.

Quantum physics, then, ultimately challenges our traditional place-oriented understanding of physical reality. Nevertheless, in describing quantum mechanics in non-mathematical language, as when describing weird science fiction landscapes, we turn inevitably to images drawn from our daily experience of the environment. In an earlier chapter of The Cosmic Code, for example, Pagels talks comfortably of quarks, leptons, and gluons as being at the "'rock bottom' of the material world."⁶ It is with the use in Dune of conventional geographical assumption to describe both an alien world and a new approach to our understanding of the physical world that we are concerned here. Before turning to our investigation of these various descriptions of setting, however, we should first take note of a potential distinction to be made between these two uses of our common geographical understanding, for whereas the first uses it as a fund of images with which to convey meaning, the second has at times a radical tendency to see our conventional geography itself as a metaphor. The physicist Roger Jones talks, for example, of the 'spatial metaphor' which, he claims, "spreads out and disentangles the otherwise continuous, chaotic experiences of what may well be a supraspatial or nonspatial world."⁷ Jones is suggesting that our geographical sense is in itself a mental construct. Fritjof Capra, in his well-known investigation of connections

between modern physics and Eastern mysticism, The Tao of Physics, seems to agree: "the concepts we use to describe nature are limited . . . they are not features of reality, as we tend to believe, but creations of the mind, parts of the map, not of the territory."⁸ In Dune, Frank Herbert uses geographical images in the construction and communication of meaning firstly in the creation of a conventional fantasy world which seems to obey the laws of traditional Newtonian 'common-sense' physics, and secondly in the description of a multi-dimensional universe which doesn't. This double focus practically conflates the two levels of geographical metaphor: shared geographical images, which seem to reflect a shared objective reality but which in fact may well reflect only a shared system of perception, are used firstly to create the appearance of an alternative reality and secondly to approach the possibilities of a different system of perception.

The 'alternative reality' and the 'different system of perception' provide Herbert with the two main settings or fields of action in Dune. The first is the apparently three-dimensional theatre of events which makes up the conventional background for the novel, a richly detailed system of locations which range from the galactic to the local. We learn of the planets--Caladan, Giedi Prime, Salusa Secundus, Arrakis--which represent the warring factions of the novel's plot, and we watch that plot unfold in their gardens, palaces, caves, tents and battlefields. Most of the novel's conventional action takes place on the planet Arrakis, known as Dune; indeed, so vital to that action are the planet's life forms and ecological development that to say that the action "takes place" there is to disguise the extent to which the planet itself seems to function as a protagonist. A large part of the success of the novel Dune (and it has certainly been successful)⁹ can be put down to the way in which Herbert places his action; the settings are reliably imaginable but interestingly strange. The balance is struck very well. Brian Aldiss and David Wingrove, in their book Trillion Year Spree: The History of Science Fiction talk of "an attention to sensuous detail" in the novel. "The bleak dry world of Arrakis," they tell us, "is as intensely realized as any in science fiction."¹⁰

There is a second landscape operating in Dune, however, a landscape equally imaginary but less conventional--a landscape even stranger and harder to visualise than Dune's dry world of tidal sands and spice masses. This is the landscape of "time-become-space," the second landscape known to Paul: "*I have another kind of sight*," he says, "*I see another kind of terrain*"¹¹ The two settings of Dune reflect the two areas in which the

hero, Paul, must operate: while the planet Dune is the theatre in which he must actually live out his history in the 'real-now', the equally realised landscape of his time-sense is the theatre in which he must confront the complexities of his conscious existence within multi-dimensional space-time. Of course, we could argue that one of these settings is supposed to be 'real' while the other is merely Herbert's metaphorical representation of Paul's indescribable mental processes. But this would be to oversimplify things. Both are imagined; both are created by reference to familiar geography and terrestrial geo-spatial assumptions; both are presented as landscapes of essential action. In some ways, it is the less conventional landscape of space-time that is eventually the more 'real', for while the Dune landscape is functional only within the novel, the geo-spatial structure of space-time created for us in Dune provides us in the end with a functional model for approaching some of the more unsettling aspects of our own universe.

Let us begin by looking at the more conventional of the novel's two settings. How does Herbert create such imaginable strangeness? First of all, it must be said that for a science fiction novel the landscapes of Dune are not particularly weird. They are three-dimensional, have gravity, are scaled to recognisably human characters, have terrain, sky, wind, weather and animals. We can talk about them in terms of place and distance. Dune itself--with its desert wastelands and giant sandworms--is the landscape that everyone remembers from the novel, but the planet on which the story opens, Caladan, Paul's home, is almost equally important. Caladan is an Earth perfected and shaped to present as strong a contrast to the dry world of Arrakis as possible. It is thus useful in two ways: it is sufficiently Earth-like to help ground the reader, and in its fertile wetness it stresses by contrast the aridity of Dune. Caladan is a world of stone palaces, meadows, rivers, green farm lands and river orchards, fountains, forests and, above all, cool rain. Paul's mother Jessica remembers "southern jungles, above the weed-wild shouting leaves and rice paddies of the deltas," "moonlit waves . . . throwing white robes over rocks . . . and the wind heavy with dampness." (242, 295) Caladan/Earth is the starting point for both protagonist and reader--and so we share with Paul the transition from familiar to strange as he and the action move to Arrakis. The device of opening the story in an Earth-like environment before moving it to one more strange, and of thus giving the novel's main characters an Earth-like home planet to which they can refer is a clever one. In this way, Herbert

neatly justifies the free use of embedded references to the familiar landscapes of Caladan/Earth.

Once on Arrakis, or Dune as it is more commonly known, we can fix our understanding of its landscape by reference to our own geographical experience directly through embedded references to Earth landscapes and indirectly through the references that Paul and his mother Jessica frequently make to their own home environment. The major geo-spatial structure that Herbert uses in his creation of the Dune landscape is that of the contrast between landscapes of place and wildernesses of placelessness. This tension functions well within the novel's plot. We gradually move away from a vision of Dune as a meaningless wilderness to see it instead as a system of meaningful places, and this movement reflects Paul's gradual achievement of safety and power on Dune. Paul's establishment of control and understanding within what seems at first to be a meaningless and unsurvivable wasteland also suggests in a simplified form the positive values of a 'leap into the void.' He leaps--and finds meaning. This achievement prepares us for Paul's struggles with the second of his theatres of action: he wrestles sense not only from the desert but also from the shifting landscape of his multi-dimensional sense of space-time. In this way, *Dune* carries a very hopeful message: familiar place systems are not the only structures within which we can find meaning and security; wildernesses and voids are not necessarily annihilating.

Let us look more closely at the way in which Herbert effects the transformation of the Dune landscape from wilderness to place system. In the first half of the novel the landscape of Dune is indeed remarkably placeless. It is introduced to us (and to Paul) in all its threatening placelessness by the Reverend Mother Gaius Helen Moham:

'You'll learn about the funeral plains,' she'd said, 'about the wilderness that is empty, the wasteland where nothing lives except the spice and the sandworms.' (34)

This early Dune is characterised by absence: no water, no life, no landmarks. The ducal residence at Arrakeen is "a cold house," marked by "confusion;" its great hall is cold and barren, full of "open spaces" and "bleak stone." Outside the sky looks "black and cold;" it is a "too-dark sky hung over the slope like a blot." (63) "The whole city feels cold," says Jessica. (50-1) Jessica is worried by Arrakis, she fears it: "how easy it is to kill the uprooted plant," she said. 'Especially when you put it down in

hostile soil.” (64) The Duke’s image of Dune also presents it as a cold and placeless wilderness:

The central wastelands beyond those moon-frosted cliffs were desert--barren rock, dunes and blowing dust, an uncharted dry wilderness with here and there along its rim and perhaps scattered through it, knots of Fremmen. (79)

The chilly image of moon-frosted cliffs is repeated: this is a landscape lit weirdly by the moon, not warmed and opened by the sun. Jessica later notes “a moonshadowed expanse of sand” and Paul “moonshadowed rocks”. (163, 181) Faced with the necessity of surviving in the wilderness of Dune’s desert Paul’s mind revolts against its placelessness. The dunes are endless, showing “greased shadows so black they were like bits of night.” He is stunned by the flatness.

His mind searched for something tall in that landscape. But there was no persuading tallness out of heat-addled air and that horizon--no bloom or gently shaken thing to mark the passage of a breeze . . . only dunes and that distant cliff beneath a sky of burnished silver-blue. (250)

The terrifying placelessness of the hostile Dune environment is brought home most clearly by the description of the storm that Paul and Jessica survive at the turning point in their relationship to the planet: this is a flight through utter placelessness to final safety. As they rise up into the storm they lose all spatial and temporal orientation:

Another burst of lifting wingbeats and they came out over rocks, silver-frosted angles and outcroppings in the starlight. . . . /Their ‘thopter . . . surged south-west towards the storm and the great curve of desert. In the near distance, Paul saw scattered shadows telling where the line of rocks ended, the basement complex sinking beneath the dunes. Beyond stretched moonlit fingernail shadows--dunes diminishing one into another

And above the horizon climbed the flat immensity of the storm like a wall against the stars. . . . They appeared to glide into a slow clouding of dust that grew heavier and heavier until it blotted out the desert and the moon. The aircraft became a long, horizontal whisper of darkness lighted only by the green luminosity of the instrument panel. . . . /Jessica had the eerie feeling that they were standing still, that all motion was external. . . . (218-20)

As they watch the storm die beneath them they see it “trailing away like a dry river into the desert,” an image powerful with paradox. The conflation of water with sand in some kind of ocean/desert is much used in

Dune. It gives us a way of apprehending the nature of Dune's open desert by reference to our understanding of open water.

It is rather difficult to imagine a truly placeless and disorienting landscape, partly because any static environment will offer us some possibility of placing ourselves--we can, at least, leave footprints, break twigs, drop crumbs. Perhaps the closest we can come to imagining utter placelessness is to picture ourselves lost at sea, a speck amid rolling waves. The shifting placelessness of the ocean would not, at first sight, seem a likely image for the aggressively arid landscape of Dune; nevertheless, it is used repeatedly. The introduction of the idea of ocean waters begins with the book's displaced use of maritime terminology. There is talk of 'space bags,' 'crossings,' 'navigators' and 'open sand experience.' The cautious Guild behaves "like a man testing the sand with his toe to gauge its temperature," and the desert behaves like an ocean: there are sandtides, "the variation in level within certain dust-filled basins on Arrakis due to gravitational effects of sun and satellites," and Tidal Dust Basins "in which actual dust tides . . . have been measured." (426, 501, 504) El Sayal is "the 'rain of sand'" and an Erg is "a sea of sand." (492) The desert is a place of currents, tides, waves and whirlpools; the sandworms are fish. A cliff is "like an ancient battleship of the seas outlined by stars," (198) or has "great streaks of rock crossing it like waves." (385).

[Paul and Jessica] stood atop a cliff with the desert stretched out like a static ocean some two hundred metres below. It lay there full of moon-silvered waves--shadows of angles that lapsed into curves and, in the distance, lifted to the misted grey blur of another escarpment. (235)

Where the Duke pointed, crescent dune tracks spread shallow ripples towards the horizon and, running through them as a level line stretching into the distance, came an elongated mount-in-motion--a crest of sand. It reminded Paul of the way a big fish disturbed the water when swimming just under the surface. (116)

The mound lifted in front, dusting away like a bow wave in water. (243)

[There was] a hissing--like the wind, like a riptide where there was no water. . . . /Where the dunes began, perhaps fifty metres away at the foot of a rock beach, a silver-grey curve broached from the desert, sending rivers of sand and dust cascading all around. It lifted higher, resolved into a giant, questing mouth. It was a round, black hole with edges glistening in the moonlight. (253-4)

This last passage presents us particularly clearly with the cold terrors of absence: a waterless tide heralding a black hole glistening in moonlight.

The conflation of desert and ocean that is the dominant image of Dune in the first half of the novel creates a very disorienting world. It uses the connotations of placelessness to deny an imaginable place its geographical reliability, reinforcing instead the idea of a wilderness of desolation and threat. Gradually, however, Paul and Jessica learn how to move within the desert and to place themselves within it. They hear birdsong, watch the stars, find traces of human activity. Gradually, Paul begins to find Dune beautiful. This change in the description of Dune takes place during the time Paul and Jessica spend alone in the desert, the time between their initial 'thopter escape and their first confrontation with the Fremen. One crisis at this turning point is the 'thopter flight itself, described above; another is the loss of their pack in a sandslide; a third is the crossing of the open desert to the rocks.

Part of the horror of the open desert for Paul and Jessica is its insubstantiality--its constant and rhythmless movement. It denies the relief of stasis: faced with the desert, Jessica knows that mercy is "the ability to stop, if only for a moment." (235) The dynamic placelessness of the desert is reinforced for us when a sandslide buries Jessica and the survival pack. Paul locates and saves his mother, and must then try to find the pack. Significantly, he can only do this by chemically immobilizing the loose sand and turning it into firm substance. Immediately after this experience, Paul notices tent anchor holes in the rock. Jessica is not surprised: it is "a likely place." Next, they notice vegetation in the distance, "There may be people nearby," Paul guesses. They are beginning to place themselves.

Soon, Paul and Jessica must move again, this time to attempt a crossing of a wide tract of open desert to facing cliffs. They set out: "Time stretched out around them," and "the rock face ahead seemed to grow no nearer." They seem to move without progress, trapped at "an unmarked point." They move on and on, muscles reaching "a stage of mechanical aching that seemed to stretch out indefinitely," Jessica in "a void of concentration." It is characteristically 'placeless' to have no way of sensing time passing: there are no landmarks to indicate rate of progress from one place to another. Movement becomes meaningless. Finally, having successfully made the crossing, they arrive in a shallow, rocky basin. "What a beautiful place," Paul says. "Like a fairyland." They are about to meet the Fremen of Dune, and this, of course, is a Fremen place, full of life: mice, birds, "bushes, cacti, tiny clumps of leaves." (256) Its placefulness is an enormous relief.

With the placing of the Dune desert wilderness, the primary fictional setting of Dune becomes less crucial--it is less strange, more Earth-like. In the second half of the book, the more easily imaginable, interior spaces of Fremen life become more important, and the focus of environmental interest shifts from Dune itself to the landscape of space-time encountered primarily by Paul as his prescient understanding of a visible future develops. Before turning to look at this, the second of Dune's explicit settings, let us pause to consider here the ways in which the actions, thoughts and feelings of the major characters of Dune are described in patterns which reinforce the assumptions about the importance of place which are at work in its primary setting.

In general, as we have seen, the popular conception of place involves the idea of location in some system or order. It involves the interaction of people with environment over time--the bonding of associations and accrued symbolic meaning to landscape. Place is also associated with reliability, with values and ideas that remain steady through time, and with 'reality.' It often involves the positive connotations of the familiarity of home. Place, unless explicitly defined as dangerous, implies safety. The place images of Dune tap into all of these associations.

We have already noted the connection of social with spatial place--another example is to be found in Jessica's explanation that the Fremen "could be wielded like a sword to win back Paul's place for him," (304)--but we should note the importance in Dune of the symbolic meaning of place. The novel opens, for example, with a quotation from one of the Princess Irulan's books stressing the importance of place to any understanding of the history of Paul Muad'Dib: "take care that you first place him in his time. . . . And take the most special care that you locate Muad'Dib in his place: the planet Arrakis. . . . Arrakis, the planet known as Dune, is for ever his place." (9) The idea of place as the marker of interaction between people, environment and history is evident here, as it is also for example in Paul's awareness of how his life history is becoming mapped on Dune: "Will Fremen stop here in the future," he wonders, "each to add another stone and think on Muad'Dib who died in this place?" (368) The Sietch communities of the Fremen provide a clear example of the interaction of people and place at home: a Sietch, which literally means "a meeting place in time of danger," is an almost organic entity. A place is a centre of feeling and life: when Gurney Halleck first realises that, Paul alive, his Duke lives, he responds with strong emotion, feeling that "a place that had been dead

within him began coming alive." (393) There is something about a place that endures. In their unshakeable strength, both Paul and the Reverend Mother Gaius Helen Moham are surely attributed with place values as they are pictured standing unmoved in the face of storms. Paul recites the litany of fear:

I will face my fear. I will permit it to pass over me and through me. And when it has gone past me I will turn to see fear's path. Where the fear has gone there will be nothing. Only I will remain. (220)

She looked as though a breeze would blow her away, yet there was that about which suggested she might stand untouched in the path of a coriolis storm. (334)

Finding Paul, discovering that he was yet a man with a leader, Gurney Halleck felt a renewed sense of place. Hearing that his son has been killed, seeing himself as the trigger for literally universal disaster, Paul conversely loses all sense of inner place. "He felt emptied, a shell without emotions." (433) If place implies life and meaning, its lack suggests death and chaos. Earlier, coping with the death of his father, Paul had experienced similarly terrifying feelings of emptiness. His lack of expressible grief becomes a "hollow place somewhere separated from his mind," "an empty place within him": faced suddenly with the terrible truth of his ancestral responsibility, Paul panics--"the emptiness was unbearable." (187-8) Doomed, Paul's father had been described as a point of absence even before his death: "Paul stared at the place where his father had stood. The space had been empty even before the Duke left the room" (96). The Shadout Mapes, too, dies into absence, her eyes "black-shadowed emptiness." (155)

The fact that lightless voids, black bins, precipices and pits are images of uncertainty and terror in Dune is hardly surprising. It is nonetheless worth pointing out that these conventional images do indeed occur conventionally in the novel, firstly because the actual Dune landscape is not distinguished by voids, chasms, precipices and pits, and so these images stress the way in which the background grid of landscape meaning is coming--naturally enough--from outside the fantasy world. The second reason to note these references is that elsewhere in the novel images of placelessness are presented in an unconventionally positive light. It is clear by the end of the novel, for example, that the black void of the box that the Reverend Mother used to test Paul at its beginning was not the unequivocally terrifying thing it seemed to be. We shall return to this box later, but meanwhile let us take for two examples of the use of

conventionally distressing images of placelessness in the novel the description of Jessica's reaction to a narcotic--"Consciousness . . . receded, sinking her into a black bin of terror"--and of Duke Leto's acceptance of the fatal move to Arrakis, in making which, people said, "he walked heedlessly into the pit." (157, 78)

The specific landscape images which occur most frequently in Dune are naturally enough those which relate closely to the tensions separating place and disorientation. As we have seen, there is a large range of explicit references to the concepts of place and of placeless wilderness. Other landscape images used frequently in the description of character and action relate closely to these central concerns. They can be divided into four major groups--images of water, vegetation, aridity and sand. This is not surprising, perhaps, given that the main setting of the novel is a desert wilderness in the early stages of a green revolution; but these images are noticeably used to reinforce the importance of the tensions between the concepts of place and placelessness in the novel. The landscape of incidental reference is stripped down into images of location and disorientation, survival and destruction.

In looking at the importance of images of location and disorientation in Dune we have already looked closely at the ways in which images of water are used to suggest certain qualities of the imagined desert landscape, and in doing so we have focused on a particular type of water image--that of large expanses of open, moving water such as oceans and seas. This type of water image is also widely used outside the description of setting, and again it is associated with the terrors of placelessness and the dangers of uncontrollable large-scale movement. The assumption that masses of water are beyond our powers of mental and physical organisation is basic to images such as this rather uncharacteristically mixed one describing Jessica's sense of a loss of control: "she could sense life flowing around her and she had no grasp on its reins." (305) Water masses, like voids, threaten annihilation and loss of self: while Paul maintains his identity and is "an island of selfdom," his mother is threatened by the tides: "Jessica recoiled, fearing she would become lost in an ocean of oneness." (331,340) Any attempt to impose land systems on seas is unsettling. A ship at sea imitates place but cannot achieve its stability: returning to the real present from her timeless encounter with the collective past of generations of Reverend Mothers "[Jessica's] mind still rolled and surged from the contact. It was like stepping to solid land after weeks on a heaving sea." (422) If living on

board ship in water is disorienting, swimming in it requires even more of an adjustment. Jessica thinks of the difficulties of adapting to Fremen life in terms of achieving orientation within disorienting waters. "Survival is the ability to swim in strange water," she thinks, deciding that she and Paul "must find the currents and patterns" in order to live. In other words, they must 'place' the ocean. (296)

The forces of order are predictably called the "major dams against anarchy" in *Dune's* second appendix for, most notably, masses of moving water are associated in the novel with anarchy, chaos and random creativity. We have already noted the novel's ambivalent attitude towards chaos and order and will consider it more fully later, but we should note here that this is not a uniformly negative set of associations. The double edge of chaos--it threatens death but stirs up life--is well presented in the stream/flood image used by the Reverend Mother Gaius Helen Moham to describe the human instinct for outbreeding: "The race knows its own mortality and fears stagnation of its heredity. It's in the bloodstream--the urge to mingle genetic strains without plan. The Imperium, CHOAM Company, all the Great Houses, they / are but bits of flotsam in the path of the flood." (27-8) "Chips in the path of the flood," Jessica calls herself and her family; Paul sees where it leads, from a "wild outpouring" to a "great new pooling of genes." Paul unwillingly sets this wildness in motion, stirring up the Fremen masses, who at times seem almost to personify a turbulent sea. At one point Jessica passes through a crowd of them to Paul, feeling "that she swam in a sea of robed and stinking backs." (291) At another "the throng stirred, rippling with whispers and currents of disquiet." (334) Jessica, caught up irresistibly in the unfolding of Fremen prophecies, finds herself swept into a central role in the dangerous ritual of poison transformation. She prepares herself, "feeling the ceremony close around her with a current that swept her beyond all turning back." (335) There is the other side to moving water, however. It is creative; it is dynamic. When Liet-Kynes suddenly saw a new and possible future for Arrakis "the possibilities . . . flooded through him." (263). It is said of Paul Muad'Dib that "Ideas gush[ed] from his words." (331) Heroic fighting forces like the Duke's soldiers come in "waves"; and the Fremen, boiling for action, do too: "We are taking them at the crest," thinks Jessica. (79, 37, 408)

Images of water which present a gentler, more controllable image tend to be those which focus on smaller amounts of water, water which often

provides the place-making centre of a dry landscape. In these cases, pools, springs and baths suggest the relief and comfort of the available 'tame' water of a resting place. This type of water therefore poses no threat to a terrestrial place sense. Thufir Hawat's eyes, for example, offer calm intelligence: they are "two pools of alertness in a dark and deeply seamed face." (32) The news that Jessica and Paul have escaped the Baron Harkonnen soothes Leto as he dies: "the words were a wash of calmness through him." (174) Similarly, for Paul, the litany against fear is "a cool bath washing over him." (288) To conclude this look at Dune's water images, we should consider the implications of the sentence "Paul spoke dryly, probing the emotional undercurrents." (405) Here, surely, squashed into these seven words, we can find Dune's central images of aridity, water, and the investigative immobilisation of flux.

For a novel with such a barren setting, Dune makes remarkable use of images of organic growth and vegetation--images again closely connected with our expectations of place. This ties in, of course, with the ecological theme, the idea of the eventual greening of the desert. The source for these images is not, however, the existing Dune landscape. The green of Leto's memories comes, of course, from Caladan. It reverberates with us, despite our lack of familiarity with Caladan, by reference to Earth. He remembers not only open water and waves, "days of grass instead of sand," but also "dazed summers that had whipped past him like windstorm leaves." (125) The vegetation of Dune is at the time of this story not much beyond scrubby bushes and small plants. The images of vegetation that Herbert uses, however, are of trees, wetland plants, seeds and flowers. The willow is an image of purpose: alone, it bends before the wind, but joined at last by other willows it stands before the wind unmoved. Roots and branches are images of beginnings and sources; the unbending death of Dr. Yueh is likened to the toppling of a tree. (31, 214, 171) Jessica knows that beginnings are times of peril: "The young reed dies so easily." (279) Hostile soil kills uprooted plants as Dune destroys the men of Caladan, and the isolated Harkonnen forts and towns are "cut away from their source like stalks severed from a plant and left to wither." (425) More closely connected with the idea of the ecological development of Dune is the image of the planet as a planting ground. The Princess Irulan in one of her quoted writings makes extensive use of this image. Talking of the "seeding [of] the known universe" with prophecies, she asserts that with "the Lady Jessica and Arrakis, the Bene Gesserit system of sowing implant-legends through the

Missionaria Protectiva came to its full fruition." (50) Paul is conscious that he, too is "a seed," and he comes to realise "how fertile was the ground into which he had fallen," something one could not literally say of the Dune desert lands, which can show only a sandworm with "its mouth spread like some enormous flower." (382) Dune's arid landscapes have only the potential for future greenery, but pushing them toward that potential are the organic tribes of Fremen, at times themselves almost indistinguishable from vegetation: as a Fremen-Sardaukar fight brews up, for example, Fremen reinforcements spring from the ground like instant greenery. "Abruptly, the sand around the two groups sprouted Fremen." (208)

Let us turn to the images of aridity. The connection of dryness with fear is both geographically and biologically natural; it is also naturally associated with wildernesses and the inhospitality of placeless environments. If fear seems to become almost inevitably signified in Dune by dry lips and a difficulty in swallowing, this is at least a sensation with which we can all identify. Characters try "to swallow in a dry throat" at moments of crisis at least eight times in the novel, but there are other images of aridity as well. The crucial scene at the beginning of the novel in which the Reverend Mother Gaius Helen Moham tests Paul with the black box and the Gom Jabbar provides several examples. It is opened by the departure of Jessica, striding from the room "in a dry swishing of skirt." Paul, predictably, tries to swallow in a dry throat, and the Reverend Mother places a "a dry finger" on his neck. Soon "his lips were so dry he had difficulty separating them." Finally, the pain stops. Sweat bathes his body. The connection of aridity with placelessness and a loss of meaning is well indicated in a scene between Paul and his father, Leto. The Duke suggests that their coming to Arrakis may prefigure much evil, and Paul swallows in a dry throat. "His father's words carried futility, a sense of fatalism that left the boy with an empty feeling in his chest." (103) Its association with absence and extinction is made clear at the time of Leto's death: "Leto could feel the chains, the ache of muscles, his cracked lips, his burning cheeks, the dry taste of thirst whispering its grit in his mouth." (172)

To complete this look at the main types of landscape imagery at work beyond the explicit settings of Dune let us turn to the question of sand. The connection of sand and dunes with insubstantiality has already been suggested above in the conflation of dune landscape with ocean. Sand is, of course, also traditionally associated with the passage of time, with the transitory nature of experience, with futility and hence with the eventual

insubstantiality of place. Sand is heavy, uncountable, worthless, meaningless. Paul puts sand in Gurney Halleck's bed on Caladan as a practical joke; a stupid man is "sand-brained" or as dim as the chicken that pecks at sand and thinks it grain; and at a moment of despair Jessica calls her grief "*heavier than the sands of the seas.*" (198) References that connect sand with time can seem sometimes more literary than geographical, as perhaps in Paul's feeling that "all his past, every experience before this night, had become sand curling in an hourglass." (180) This image reminds us of one of Gurney Halleck's many quotations: "*My lungs taste the air of Time / Blown past falling sands . . .*" (79) Perhaps it is something about the nature of sand, grains separate but numberless, that is so depressing; we imagine ourselves at that scale and feel lost in time and space, eternally at sea. Jessica herself is almost literally lost beneath a sandflow, as we have seen above; she dreams she has lost her husband in its figurative equivalent.

She had held dreaming hands beneath a sandflow where a name had been written: *Duke Leto Atreides*. The name has blurred with the sand and she had moved to restore it, but the first letter filled before the last was begun. (196)

Almost immediately after this dream Jessica looks at the real sand around her. "A shower of sand from the surface brushed her left hand. *How much sand will the hand hold?* she asked herself." (197) We are back, at the end of this look at submerged environmental images, where we started--with the shifting placelessness of sand. It is not only spatially disorienting in its large-scale physical manifestation as desert landscape, it is also figuratively disorienting in its denial of the concept of a permanent significance within time. The image of sand in Dune represents disorientation and a lack of meaning in four dimensions, images which prefigure Paul's understanding of space-time.

Having looked at a range of images conventionally associating place with positive values and placelessness with negative, let us turn to look more closely at the evidence of ambiguity in this area and at the ways in which Dune brings us gradually towards a tolerance for the void. We should begin by looking at the novel's admission of the attractions of spatial systems of knowledge. As Paul has learned, "the human requires a background grid through which to see his universe." (11) However, as Dune points out, the grid is imaginary; it is the intelligent construction of an experience that would otherwise be overwhelming. The spatial

organisation of knowledge involves a mapping process: a selection and a shaping of reality somewhat similar to what Paul Muad'Dib in his 'Sayings' calls "the attitude of the knife--chopping off what's incomplete and saying: 'Now it's complete because it ended here.'" (166) Paul is distinguished in the novel by his superior ability to see things spatially. He is spectacularly good at conceiving of the higher dimensions of flowing space-time within the terms of conventional fixed-time spatial images. This mental ability is prefigured early in the novel by his physical skill in seizing an assassin's deadly hunter-seeker as it flashes past him, distracted from its primary target by the movement of the Shadout Mapes:

The hunter-seeker arrowed past his head towards the motion.
Paul's right hand shot out and down, gripping the deadly thing. It hummed and twisted in his hand, but his muscles were locked on it in desperation. With a violent turn and thrust, he slammed the thing's nose against the metal door-plate. He felt the crunch of it as the nose eye smashed and the seeker went dead in his hand. (69)

Much later in the novel Paul does practically the same thing within the landscape of his time-space awareness; seizing one element of it, for example, "he felt a wrenching sensation within his awareness as though he were trying to grasp some thing in motion and render it motionless." (297) Paul is distinguished, then, not only by his ability to conceive of reality-in-flux but also by his ability to grasp it, map it, in the instant it passes him.

Paul is, nonetheless, aware of the dangers of grasping the truth of a moment, dangers well expressed by the First Law of Mentat: "A process cannot be understood by stopping it. Understanding must move with the flow of the process, must join it and flow with it." (35) He managed to seize the hunter-seeker, after all, but in doing so he killed it. In searching his memory--which includes both past and futures--Paul scans through "arrested / instants of time," but these fragments are "difficult to understand when snatched out of the flux." (341-2) Things move, time passes, places change. The historical associations which give a place the aura of being fixed within both time and space are illusory, as Paul finds out when he looks around the training room on Caladan; bereft of its familiar objects it is no longer home. "It struck him as an odd place suddenly, a stranger-place with most of its hardware already gone." (33) The creation of place and of system is the result of a mental effort; it can be constructive, but it can also be dangerously limiting. A sensitivity to constant change--a sort of intuitive spatial calculus--is required.

There is, then, in the novel Dune, an ambivalence towards the value of structure. Rhythm and form are inherently satisfying, but the unpredictable excites. It is reassuring to watch Paul gradually fulfil the Bene Gesserit prophecies on Dune. Of course he is the long-awaited Kwisatz Haderach; of course he can't be killed half way through the book; of course he will defeat the Baron Harkonnen and ascend the Imperial throne. We have lived through plots like this before. At the same time we want suspense, and we find that too. Paul is not quite what the Bene Gesserit expected. He was born too soon; he is a random variable; he thinks. By becoming a sentient part of their plot, Paul is destined to change it. The Bene Gesserit themselves may be only one part of a plan of much higher dimensions.

The same could be said for the novel itself. Dune ends with a conventional plot victory for Paul but with all the major questions still unanswered. The novel draws energy from the tension it sustains between the opposing forces of system and flood, map and explosion, order and chaos. In one way this reinforces the novel's point that life is not susceptible to solutions: as the Reverend Mother says, life is "[not] a problem to solve, but a reality to experience." (35) Another way of looking at it, remembering that Dune is only the first part of a series of Dune novels, is to see that its plot (like the Bene Gesserit's) is only one part of a larger story, a story which, it implies, is simplified in the telling. The sense of inconclusiveness therefore only reflects an incomplete understanding. This is a crucial point. If perfect systems and wrapped-up plots, like the Guild's unwavering choice of the safe course, lead "downward into stagnation" (448) then this is because they are finally self-referential. Ultimately, Dune suggests, a map or a system is only a game: it is a way of bringing the unimaginable within the scope of our imaginations. Maps, systems and plots are only representations of reality, not the reality itself.

Let us investigate this idea further by looking at the images of chaos and order in Dune. At the simplest level, looming chaos is to be avoided, found chaos put in order. Leto, Jessica, Paul and the Baron Harkonnen all talk of chaos in the Imperium as the ultimate disaster. Leto, for example, believes that presenting his case before the Landsraad would only create "a great cloud of confusion;" it would gain a little time "while risking chaos." (47) The Baron fears chaos if the Landsraad hears that Sardaukar troops are being used on Dune, and Paul is sure of his claim to the throne because it is the only way to sustain order. The Emperor, he is sure, will not take

the risk of having "planets blasted, disorder everywhere" but will accept his "alternative to chaos". (214) There is a distinct possibility, however, that galactic chaos could function as a part of a plan of larger scale. It may, as Paul suspects, be the product of a "wild race consciousness" aimed at the regeneration of stagnating bloodlines.

The race of humans had felt its own dormancy, sensed itself grow stale and knew now only the need to experience turmoil in which the genes would mingle and the strong new mixtures survive. (457)

There are patterns within patterns in Dune and there is chaos within order. People think in patterns: Jessica notes that their language is "all of a pattern," Leto finds a "whole pattern of conversation" welling up within him, and when Gurney Halleck refocuses his understanding of the Fremen war its "pattern . . . began to take on a new shape in [his] mind." (124, 45, 393). But what seems to be a complete pattern may in fact be only a part of something larger. Dr. Yueh, planning his treachery, is suddenly "caught up in the thought that he might be part of a pattern more involuted and complicated than his mind could grasp." (62) Similarly, the report on Bene Gesserit motives and purposes (Appendix III) comes to the "inescapable conclusion that [their] inefficient . . . behaviour in this affair was a product of an even higher plan of which they were completely unaware!" (485) As Jessica thinks to herself at one point: "*Plans within plans within plans within plans Have we become part of someone else's plan now?*" In these cases, apparent meaning is not ultimate meaning. There is the connected idea that apparent meaninglessness itself may be ultimately meaningful within a pattern of a larger scale. As Pardot Kynes says of science, it "is made up of so many things that appear obvious after they are explained." (262)

The appearance of accident and chance may disguise the patterns of a higher order. Jessica, for example, finds the rhythmless way she must walk across open sand horribly unnatural because it is not something which seems to 'make sense.' She breaks into a run with relief: "here was action that could be understood. Here was rhythm." But what to Jessica is unnatural is necessary precisely because it imitates the desert's "natural shifting of sand." (252-3) Liet-Kynes, the planetary ecologist, makes no mistake about the existence of meaningful systems on Dune--his vision for Dune's green future, for example, is based on a carefully worked out ecosystem of "fluid stability." (472) His inability to perceive meaning,

therefore, takes place at a higher level. Dying from exposure in his familiar desert, "once-precise movement" still just visible in his "almost-random" actions, Kynes loses his faith in a logical universe. He has previously believed implicitly in the co-ordinated ecological patterns which his father, the first planetologist of Arrakis, taught him; he too has seen Dune as "a machine being driven by its sun," a place with the potential to embody a "dazzling awareness of order." (467) How Newtonian! His father had taught him that "the highest function of ecology is understanding consequences," but as he dies it occurs to him "that his father and all the other scientists were wrong, that the most persistent principles of the universe were accident and error." (259, 264) Liet-Kynes has stumbled across the new physics. But what are accident and error? And in terms of what implied system are they defined as such? Dune suggests that beyond any frustrating wall of apparent meaninglessness there may well lie a pattern of even greater beauty. Is this the key to the subversive attraction of the chaotic in Dune? Is there a suggestion here of a faith in an ultimately explicable order behind the randomness of the quantum universe?

The Bene Gesserit breeding plan which produces Paul is aiming for a Kwisatz Haderach--one "who can be many places at once," or, in other words, "a human with mental powers permitting him to understand and use higher order dimensions." (483) They are looking for someone who can find the meaning in chaos. Paul can do this. Even as a young man, he had prescient visions which were "accurate, penetrating and defied four-dimensional explanation." (484) Through a combination of Bene Gesserit training and the Dune spice drug Paul learns to manipulate his extra sensitivity. Twice in the novel we are given a biblical quotation about the possibility of missing senses. "Think you," it reads, "of the fact that a deaf person cannot hear. Then, what deafness may we not all possess? What senses do we lack that we cannot see and cannot hear another world all around us?" (44) Jessica, tasting the spice drug, and developing a simplified version of Paul's sense of space-time, discovers one of them. "I'm like a person whose hands were kept numb," she thinks, "until one day the ability to feel is forced into them. . . . And I say: *Look! I have hands!*" But the people all around me say: *'What are hands?'*" (341) Even before he has tasted the spice drug Paul gives the impression of being aware of invisible realities. Liet-Kynes, meeting Paul for the first time, thinks that he behaves "as though he saw and knew things all around him that were not visible to others." (105)

Paul's higher senses give him a dramatic boost in understanding. He can see and comprehend ordinary spatial landscapes and he can also see and comprehend temporal space. His 'now' exists at the meeting point of at least two three-dimensional systems. Paul, presumably, can see and move within this system of space-time locations in its impossibly multi-dimensional entirety. He is indeed the prophesied "one who can be many places at once." (483) We of course cannot do this. Nevertheless, the conventional geo-spatial imagery in which this ability is presented enables us too to make an approach to this unenvisionable system of interrelated space and time. We, too, are taught to sense orientation within the void. Let us see how it's done.

We are familiar with the association of vision and understanding: "I see!" we cry, when we mean "Aha--I understand." Images of imperfect vision--landscapes draped in clouds, for example--are used throughout Dune to indicate a lack of comprehension and control. We have "clouds of confusion," logic and reason being "clouded by emotion" and sensible abilities "clouded . . . by a momentary panic." "*Hope clouds observation,*" the Reverend Mother reminds herself. (47, 223, 257, 16) Another associated image for understanding is that of the path, road or course, sometimes seen and pursued through a landscape. One word in the Fremen language tells Jessica much about their culture: "the clue of the tongue opened wide avenues of understanding." (267) Pardot Kynes set up a system of small ecological research groups so that each could "find its own path." Realising that "highly organized research is guaranteed to produce nothing new," he created intelligent disorder, sending out the research teams in many directions to explore new scientific territory. One final image of understanding we should note is that of a position of height in the landscape--the achievement of an elevation from which an overview can be obtained. It is in these terms that the Baron Harkonnen condemns the Duke Leto as "one who could not elevate a Mentat to the sublime peaks of reasoning that are a Mentat's right." (224)

All of these geo-spatial images of understanding--clear skies, the finding of paths, the overview of surrounding terrain--are used in the depiction of Paul's higher-dimension understanding of space-time. Paul's new level of consciousness begins to come into effect at the time of Dr. Yueh's treachery and his flight into the desert with his mother. "Something had happened to his awareness this night" he realises. (181) It begins with a heightening of his normal level of understanding as he moves into what

he calls "hyperalertness." Soon his mind moves on "in its chilling precision" and he begins to see the future "without even the safety valve of dreaming." His comprehension now moves beyond computation to find "an edge of mystery--as though his mind dipped into some timeless stratum and sampled the winds of the future." (186) And then, suddenly, his mind "climbed another notch in awareness."

He felt himself clinging to this new level, clutching at a precarious hold and peering about. It was as though he existed within a globe with avenues radiating away in all directions . . . yet this only approximated the sensation.

He remembered once seeing a gauze kerchief blowing in the wind and now he sensed the future as though it twisted across some surface as undulant and impermanent as that of the windblown kerchief. (186)

This is clearly an explanation based in images of mountain-climbing and landscape-viewing. The image is stretched--he is at the centre of a globe not a surface, for example, or the surface is unreliable--and declared to be ultimately inadequate, but the basic terrestrial image provides us with an imaginable simplification of Paul's experience. Paul recognises his new power in terms of terrestrial imagery: "*I see another kind of terrain,*" he realises, "*the available paths.*" Immediately, he becomes aware of one of the problems of this kind of vision, for "so many places on that other kind of terrain dipped or turned out of his sight." Here we have repeated the idea of undulating terrain--it is the "places" themselves which are moving around.

At this early stage, before he has tasted the spice drug, Paul is at the mercy of his vision. He has no power to move within it or control it. He describes it like this: "The immediate future--say, a year--I can see some of that . . . a *road* as broad as our Central Avenue on Caladan. Some places I don't see . . . shadowed places . . . as though it went behind a hill . . . and there are branches. . . ." (190) He sees the branching paths and is frightened by the ones that hold "long patches of grey obscurity" broken by "peaks of violence." (192) The immediate future--as it shades into the 'now'--can also be clouded, as Paul finds out when he and Jessica take off in the 'thopter to ride out the desert storm. That night he passes "a decision-nexus into the deep unknown."

He knew the time-area surrounding them, but the here-and-now existed as a place of mystery. It was as though he had seen himself from a distance go out of sight down into a valley. Of the countless paths up out of

the valley, some might carry a Paul Atreides back into sight, but many would not. (217)

Paul is in "blind ground" that night, as he will be much later during his fight with Feyd-Rautha. This feeling that the 'now' has been clouded is not necessarily a frightening one for Paul. Later, he receives it with "a kind of elation."

In some recent instant, he had crossed a time barrier into more unknown territory. He could sense the darkness ahead, nothing revealed to his inner eye. It was as though some step he had taken had plunged him into a well . . . or into the trough of a wave where the future was invisible. The landscape had undergone a profound shifting. (254)

Once again, we should note both the basic geosophical nature of this explanation of experience and the way in which, in space-time, it is the landscape itself which shifts, not the viewer.

With his introduction to the spice drug Paul's spatial sense of time fills out, and with this change in the depth of his understanding comes a new development in the type of landscape imagery used to describe it. The images become even more fluid, reflecting his awareness of the fluidity of merged time and place and his immersion in the flux. Paul's vision of past, present and future come together under the influence of the drug and he achieves a "trinocular vision that permitted him to see time-become-space." This vision brings its own difficulties: Paul is haunted by the fear that he will somehow lose his "position in time." (361) Like an ocean swimmer he senses the danger of disorientation, and he struggles to hold on to "the flowing moment."

In grasping the present, he felt for the first time the massive steadiness of time's movement everywhere complicated by / shifting currents, waves, surges and countersurges, like surf against rocky cliffs. . . (281-2)

For a while, water images are used exclusively to convey the shifting and multi-dimensional nature of Paul's vision. During his fight with Jamis, for example, he is aware that while he can sense the "strongest currents of the future" he is at the same time living in the "real-now" where anything can happen. At this crisis he is aware of "time-boiling variables;" the present moment lies in his path "a blurred nexus," like "a gigantic rock in the flood, creating maelstroms in the current around it." (288-9) Paul, a swimmer amid rolling waves, knows the limits of his talent.

It was as though he rode within the wave of time, sometimes in its trough, sometimes on a crest--and all around him the other waves lifted and fell, revealing and then hiding what they bore on their surface. . . . the wild jihad still loomed ahead of him, the violence and the slaughter. It was like a promontory above the surf. (304)

Twice, Herbert returns to the image of the mountain peak, and on both occasions the image seems to suggest the problems Paul faces when he views space-time objectively, placing himself as an independent actor somehow above or outside it. The first example occurs when Paul, choosing his adult Fremmen name, loses his vision of the way forward. He sees himself "perched on a dizzying summit" while "all around him was abyss." Remembering the future jihad, and horrified by the memory, Paul wrenches his behavior out of the patterns of this future, trying to change its direction. But still, "the abyss remained all around him." (292-3) The second example of this image occurs when Paul comes to drink the distilled spice water. He knows that if he drinks it he will "return to the vision of pure time, of time-become-place;" it will "perch him on the dizzying summit and defy him to understand." (342) He does drink it--and he does indeed return to that "weird dimension."

For the remainder of the novel, the images of Paul's prescient understanding are mostly those either of the boiling water masses or of radiating paths and corridors, the choice apparently largely depending on whether future time is being presented as organised or as chaotic space, as a system of choices or as an undifferentiated whirling mass. It is clearly suggested that revealed future time becomes more chaotic in nature the more Paul tries to interfere with it.

The more he resisted . . . and fought against the coming of the jihad, the greater the turmoil that wove through his prescience. His entire future was becoming like a river hurtling towards a chasm--the violent nexus beyond which all was fog and clouds. (369)

Paul's struggle to prevent the fulfilment of the pattern in which he is enmeshed--a pattern which leads towards the jihad--pushes him into the more threatening space-time of chaos; he is fighting waves, not choosing corridors. In the terms of the novel's underlying assumption that place is conventionally a positive and reassuring concept and placelessness one of threat and disorientation, this drama, presented to us as being played out in the four-dimensional theatre of his space-time, is the one in which Paul truly achieves the status of a hero.

If we were to choose the one aspect of modern physics which represents most clearly in the popular mind its confusing and unsettling nature it would probably be this baffling concept of the space-time continuum. Confusing and unsettling though it may be, however, space-time and quantum physics in general has become an increasingly popular subject. Most of the large range of popular books about quantum physics, space-time, the Big Bang and black holes readily available today had not been published in the mid-1960s when Frank Herbert produced this first novel in the Dune series, so, unless we are prepared to allow Herbert himself a prescient time sense we cannot claim that he was directly influenced by this more recent boom. Nevertheless, this is not to say that the ideas were unavailable at the time that Herbert was writing. There is at least one direct reference in Dune that makes clear the fact that Herbert was, to some extent, informed in this field--a field which was, after all, starting to become generally popular at that time. Let me say at once that I have no intention of attempting an introduction to the main points of quantum physics here. What I do hope to do, however, is to show how the landscape of Paul's time-sense relies upon and helps popularise a simplified version of some modern interpretations of the universe.

There has been, in the 20th century, a movement away from the conventional Newtonian model of absolute space and time. As Einstein has shown us, space and time are simply the products of a system of measurement, and in the four dimensions of space-time we must talk about processes rather than objects. This is a world defined in terms of probability and uncertainty. This uncertainty is unresolvable: measurement and observation, we discover, are forms of interference, and they will affect the quantity that is being measured. The inevitability of an observer's participation in the event being observed is apparently connected to a principle of uncertainty which states, basically, that the measurement of both motion and position of a subatomic particle can never be achieved with perfect accuracy.

What has all this got to do with Dune? Basically, the point is that what the Bene Gesserit call Paul's grasp of "higher order dimensions" is in fact an ability to visualise and cope with something akin to a post-Newtonian universe. His triumph over the test of the Gom Jabbar and the black box is not, as we assume at the time, a simple triumph of determination over pain. The pain is only a representation of the spatial terrors of the 'black box'-- the lightless void, the black pit into which the

Reverend Mothers cannot look, the 'place' which is placeless. Paul's triumph is mental; it is the triumph of his ability to wrench into imaginable shape the shapelessness of a universe of probabilities. The difficult, frightening thing about this universe is that it is an environment without fixed points of reference, without certainty, without places. It is the void: it is what the Fremmen called "Alam Al-Mithal," or the land where "all limitations are removed." (480) Paul fears this place "because removal of all limitations meant removal of all points of reference." Here, he cannot "orient himself and say: 'I am I because I am here.'" (363) But if this landscape denies precise orientation, it also allows in its lack of limitation new concepts of location. Paul is, of course, the "one who can be many places at once," and by destroying spatial differentiation thus he is the one who brings "the shortening of the way." (128,127) One of the features of the post-Newtonian universe is, similarly, that "two quantum particles that are widely separated in space may still constitute an inseparable physical entity." As Paul Davies explains, the principle of "quantum non-locality weaves the entire cosmos into a coherent unity."¹²

The possibility that all of time exists at all times, like a spread-out landscape, is unnerving. We like to believe in the one-directional flow of time. We like to see ourselves driving through that landscape at a steady speed--and with our backs turned to the windscreen. As Paul is quoted in the novel as having said himself: "the concept of progress acts as a protective mechanism to shield us from the terrors of the future," or, we could add, from the terrors of eternity. (306) Paul does experience time 'normally' as an irreversible process: "he could feel time flowing through him, the instants never to be recaptured." (303) But Paul and Jessica both also experience extreme forms of time relativity, especially when under the influence of the spice drug, and Iakin Nefud, addicted to the "timeless, sustained ecstasy" of the drug Semuta, drifts in and out of the present like some strange water creature. Ecstasy aside, however, it is normally reassuring to sense temporal landmarks. We like the concept of an appropriate time for things. As the Orange Catholic bible puts it, there is "a time to get and a time to lose . . . a time to keep and a time to cast away," and as the Fremmen say, "we will fight in the time of fighting." (207) Paul is aware of the timeliness of events--he knows he has "arrived before [his] time"--but he is also aware of time as a landscape, an extended present--as the Fremmen talk of an immediate eternity in their battle cry "Ya Hya Chouhada" or 'long live the fighters.' In this phrase the 'Ya,' the now, is

strengthened by the 'Hya," the "ever-extended now." (191, 506) Paul, living in this extended now, worries Jessica by the way in which he speaks of the dead in the present tense, and he, too, is worried by the fear that, conscious of the ever-extended moment, he may lose track of the real-now.

Paul is forever running the risk of losing himself, the risk that Jessica described as being "lost in ocean of oneness." This is the fear, the physicist Roger Jones argues, that underlies our dependence on what he calls the 'spatial metaphor.' In moving between the real-now and his vision of space-time Paul is moving perilously between this disentangled version of experience and its chaotic counterpart. The organisation of experience and space into time and landscapes is, as we have seen above, in Dune a willed system of comprehension, the wrenching of flux into stasis. Roger Shallis, in his book On Time, supports this view. "The map," he claims, "is a secondary / symbolic system, it is a shorthand version of part of nature, which itself is a symbolic version of a higher reality. Such a view does not deny the 'real' nature of the physical world, but expresses its relationship to a greater reality."¹³ Fritjof Capra agrees that the problem with our conventional systems of map-oriented thinking is that they break down in the face of the post-Newtonian universe. "Our language and thought patterns have evolved in this three-dimensional world and therefore we find it extremely hard to deal with the four-dimensional reality of relativistic physics," he says.¹⁴ Paul Davies, too, would agree that "the idea that the world we observe might be a three-dimensional slice through, or projection of, an infinite-dimensional superworld may be hard to grasp," and that a world model in which "space is just one three-dimensional subspace from a superspace that really contains an infinity of perpendicular directions" is "an idea totally impossible to visualize."¹⁵ Surely we would all agree with this. In coping with these problems of the visual imagination even eminent physicists start to sound like Paul Muad'Dib describing a clouded time-nexus. Sir Bernard Lovell, for example, describes the difficulties of coping with the concepts of space and time as they existed before the Big Bang as making him feel as though he has "suddenly driven into a great fog barrier where the familiar world has disappeared."¹⁶

Much of the popular writing on quantum physics available today is presented in the same sort of conventional geo-spatial images that Herbert uses in presenting Paul's prescient time-sense. Dune is, in fact, a remarkably useful introduction to quantum physics. Through its various

fantasy settings, the novel gradually develops in the reader a tolerance for strange landscapes described in conventional terms. Faced, finally, with a three-dimensional representation of four-dimensional space-time, the reader does not panic. Seen in the terms of Paul's understanding of his time sense, even the mysteries of the Heisenberg Uncertainty Principle begin to seem comprehensible. Paul's awareness of the ways in which his vision of possible futures affects their development, a phenomenon we accept quite easily, is described by Herbert in explicitly scientific terminology:

The prescience, he realized, was an illumination that incorporated the limits of what it revealed--at once a source of inaccuracy and meaningful error. A kind of Heisenberg indeterminacy intervened: the expenditure of energy that revealed what he saw, changed what he saw. (282)

In the first part of this paper we looked at the ways in which the basic concepts of place and placelessness are used to construct the Dune landscape and to indicate Paul and Jessica's relationship to it. At the simplest level, the novel assumes an understanding of place as reassuring and good and placelessness as terrifying and bad. Place is associated with organised space which can be understood, with systems and with order subject to human logic. Jessica assumes this when she uses the familiar superimposition of the concept of social on spatial place to argue that "humans live best when each has his own place, when each knows where he belongs in the scheme of things. Destroy the place," she says, and you "destroy the person." (149) Place is a good thing. Jessica remembers her dead husband Duke Leto, a strongly positive character, as a "lost sanctuary"; Paul is also, as we shall see, very strongly associated with place--in fact, he eventually becomes as much location as character. The evil Baron Harkonnen, on the other hand, has a mind which can "conceive of nothing more beautiful than [the] utter emptiness of black." (171)

Nevertheless, the simple association of place and spatial systems with security and goodness, and the absence of place and orientation with danger and evil, while effective in suggesting the changing relationship of Paul and Jessica to the Dune desert world, does not accurately reflect the real connotations of these concepts in the novel. True, Jessica believes that "humans live best when each has his own place," and the Imperium enforces a rigid class system carrying the motto "A place for every man and every man in his place," but the heroic Leto, in sympathy with the Fremens

wish to live outside this "ordered security", finds himself questioning this rule. "The Duke felt . . . that his own dearest dream was to end all class distinctions and never again think of/deadly order." (78-9) In one of the chapter headings taken from 'The Collected Sayings of Muad'Dib' we see the same association of order with death.

There is in all things a pattern that is part of our universe. It has symmetry, elegance and grace. . . . We try to copy these patterns in our lives and our society, seeking the rhythms, the dances, the forms that comfort. Yet, it is possible to see peril in the finding of ultimate perfection. It is clear that the ultimate pattern contains its own fixity. In such perfection, all things move towards death. (361)

There is at the heart of Dune a questioning of the concepts of place, placelessness, order, chaos, stasis and movement as they are conventionally constructed in spatial terms. This ambivalence, which functions sketchily if at all in the novel's primary setting, becomes absolutely central in the secondary setting of Paul's space-time. An uncertainty with regard to the common sense view of space and a new interest in a spatial understanding that can transcend the limits of conventional 'place' are evident.

There is an understandable popular fascination with the mind-stretching theories of contemporary physics, but these theories can easily provoke the feeling that to think in such terms is to throw oneself off a cliff into never-ending space. This is somehow an even worse fate than jumping off a cliff and hitting solid ground. Clearly, if physics and its implications are not going to be abandoned to the physicists we need to use our metaphorical systems in new and more flexible ways so that we can think about the new theories of physical reality without using specialist mathematical languages. Dune, in describing the space-time experiences of its hero Paul in familiar geographical images, makes a contribution to this task. It provides, in popular terms and within the comfortable outline of a familiar fictional genre, an angle of approach to a new system of thought. Just as Jessica transforms the poisonous spice water into a substance that is intoxicating but not fatal to the bodily systems of the ordinary Fremmen, so Dune filters new visions of physical reality through a familiar landscape-based system of reference and thus provides us, too, with an experience that is exciting without being threatening.

Notes

¹ Gary Zukav, The Dancing Wu Li Masters: An Overview of the New Physics [1979] (New York: Bantam Books, 1980) p. 168. References to works of popular science such as this will generally be made to the readily available mass market paperback editions. Dates of original publication will be given in the first reference, after the title.

² R.J. Johnston with Derek Gregory and David M. Smith, The Dictionary of Human Geography, 2nd edition (London: Basil Blackwell, 1986), p. 180.

³ Zukav, p. 20.

⁴ Zukav, p. 18.

⁵ Heinz R. Pagels, The Cosmic Code: Quantum Physics as the Landscape of Nature [1983] (London: Penguin Books Ltd., 1984), p. 320.

⁶ Pagels, p. 244.

⁷ Roger Jones, Physics as Metaphor [1982] (London: Sphere Books, 1983) p. 63.

⁸ Fritjof Capra, The Tao of Physics: An Exploration of the Parallels Between Modern Physics and Eastern Mysticism [1975] (London: Fontana, 1983) p. 177.

⁹ In 1986, Dune was in its 33rd printing with its second publisher with 2,420,892 copies. For a comparison of these figures with those of other popular science fiction novels, see Brian Aldiss with David Wingrove, Trillion Year Spree: The History of Science Fiction (London: Paladin Books, 1988) p. 487.

¹⁰ Aldiss and Wingrove, p. 398.

¹¹ Frank Herbert, Dune [1965] (London: New English Library, 1972) p. 281, p. 187. Further page references to Dune in this paper will also refer to this edition of the novel and will be given in parentheses within the text.

¹² Paul Davies, Other Worlds: Space, Superspace and the Quantum Universe [1980] (London: Penguin, 1988) p. 201.

¹³ Michael Shallis, On Time: An Investigation into Scientific Knowledge and Human Experience [1982] (London: Penguin, 1983) pp. 182-3.

¹⁴ Capra, p. 163.

¹⁵ Davies, pp. 103, 138.

¹⁶ A.C.B. Lovell, from The Individual and the Universe, quoted in Capra, p. 219.