

Relativity and Quantum Theory in Virginia Woolf's *The Waves*

By Ian Ettinger

Ian Ettinger, a student in the City University of New York Liberal Studies program, is preparing a master's thesis on the relation of Virginia Woolf's Mrs. Dalloway to space-time, selfhood, and the politics of everyday life.

Let us again pretend that life is a solid substance, shaped like a globe, which we turn about in our fingers. Let us pretend that we can make out a plain and logical story.

— Virginia Woolf, *The Waves*

The notion of a reality beyond appearances figures prominently in the earliest human mythologies, and has been a central focus in art, philosophy, religion, and science for centuries. Needless to say, there is nothing uniquely modern about it.¹ What is revolutionary about the early twentieth century is the rise of inherently strange representations of reality that are antithetical to common sense. Some of the best-known theories posit space and time as relative quantities, light and matter as both wavelike and particulate, and reality and consciousness as interpenetrating.² Einstein, Bohr, and Heisenberg formalized many of these principles scientifically, but physicists were by no means the only ones exploring new conceptions of reality and new ways of representing it. Scientists, philosophers, and artists alike became convinced of the inadequacy of classical and realist approaches to reality, which they abandoned in favor of highly abstract models. Since theoretical physics became the authoritative source of knowledge regarding the fundamental components of the universe, the array of abstract models generated by modern artists and philosophers shared many key concepts and

characteristics with modern physics. In *Einstein, Picasso*, Arthur I. Miller correlates relativity with Cubism, arguing, “Einstein’s temporal simultaneity matches Picasso’s spatial one. Both amounted to representing nature from several viewpoints at once. How you measure or view a scene, that is what it is.”³ Just as Einstein asserted that reality is always relative to one’s position and speed in relation to an object or event, artists such as Picasso depicted aesthetic forms through simultaneous, fragmentary perspectives. Both models suggest that a complete understanding of any situation would require access to many vantage points at once, since nothing can be defined through a unitary perspective.

In modernist fiction, several novels enfold similarly complex and indeterminate visions of reality. Proust’s *À la recherche du temps perdu*, Joyce’s *Ulysses* and *Finnegans Wake*, and Faulkner’s *The Sound and the Fury* and *Absalom, Absalom!* all disrupt linear narratives and complicate identity and representation. However, Virginia Woolf’s *The Waves* pushes the notion that reality is not as it appears further than perhaps any other modern novel. Clock time gives way to “felt” time, moments expand into atemporal stasis, decades contract into brief flashes, and separate objects, including human bodies and personalities, intermix with and indefinitely affect one another.⁴ Amid the radical reconceptions proposed by physics, *The Waves* appears to be the only modern novel to attempt a complete rereading of how identity functions and becomes embodied in the indeterminate flux of space-time. The novel discloses a world beyond sense perceptions, one in which nothing is as separate or solid as it appears, time expands and contracts in wavelike patterns, and the voices and identities of six characters become the many facets of a “mass mind individualized”,⁵ calling into question the very existence of discrete objects and individual personalities.⁶

This essay will consider Woolf’s fiction alongside modern physics, briefly examining *To the Lighthouse*, which manifests a unique vision of space, time, and perception, and arguing that *The Waves* elaborates Woolf’s most complex and challenging elucidation of life.⁷ Understanding Woolf’s work in relation to relativity and quantum theory may help to further discussions of the ways in which physics—as the supposed authority on the nature of reality—influenced artistic and philosophical models throughout the modern era (and how it continues to do so). Whether Woolf uses modern physics as a platform to evolve her own vision of life, or whether her conceptions remain enthralled by these scientific models, is difficult to determine conclusively.

However, this essay will advance the argument that Woolf utilizes elements of modern physics to synthesize her own vision of reality, and thereby pushes beyond these paradigms.⁸

It is important to clarify that the theoretical framework of *The Waves* involves more than just physics. Most critics exploring consciousness and identity in Woolf's fiction point out that her novels appear to draw heavily upon modernist philosophy as well. Several have noted the potential influence of philosopher Henri Bergson, who proposed his own theory of time prior to Einstein's publications of 1905.⁹ Bloomsbury philosophers such as G.E. Moore and Bertrand Russell also advanced theories of perception, space, and time (which bear notable resemblances to Einstein's Special Relativity).¹⁰ An array of non-absolutist, non-positivist theories were "in the air" during Woolf's career as an author, any and all of which may have had an impact on her work.¹¹ It is also likely that Woolf was influenced by her father, Leslie Stephen, an author and historian, who asserted that "we cannot get outside our own consciousness. We know nothing directly except the modifications of our consciousness."¹² In many ways both *The Waves* and *To the Lighthouse* overtly challenge this notion, as each portrays consciousness becoming interpenetrating and reaching beyond the boundaries of individual minds. Many currents of modernist thought can indeed be read into *The Waves*, but it is critical to recognize that Woolf never tidily incorporates any particular epistemological, ontological, or physical theory, but rather assimilates several into her own vision.

The question of whether Woolf consciously experimented with modern physics, and whether she intentionally assimilates other modern visions of reality, is debatable. However, Woolf was certainly exposed to theories of physics, likely through her father, the extensive Stephen family library which she spent her childhood and adolescence devouring, contemporary publications, and her acquaintance with Bertrand Russell.¹³ Her awareness of modern physics is hinted at in *A Room of One's Own*, as she specifically mentions "physics, the nature of the atom, mathematics, astronomy, relativity."¹⁴ In her essay "Modern Fiction" she urges, "Let us not take it for granted that life exists more fully in what is commonly thought big than in what is commonly thought small." This might refer to the details of human life or even to the "small" world of subjective consciousness—if not for the sentence that precedes this one, in which Woolf expresses the desire to "record the atoms as they fall upon the mind in the order in which they fall."¹⁵ In light of the "atoms" she mentions, "what is commonly thought big" may in fact refer to all of macroscopic existence. In a scientific reading, Woolf's exhortation could imply

that life exists “more fully” at the subatomic level, since in light of modern physics “what is commonly thought big” may have little or no definite solidity. Woolf may be intimating that a fuller understanding of life can be gained from examining microscopic existence rather than the world of everyday appearances.

Relatively few recent critical works explicitly connect Woolf's fiction with physics. Among these works are Banfield's *The Phantom Table*, Paul Tolliver Brown's “Relativity, Quantum Physics, and Consciousness in Virginia Woolf's *To the Lighthouse*,” and Erica Roebbelen's “Manifestations of Twentieth-Century Physics in Virginia Woolf's *The Waves*.” Banfield focuses primarily on *To the Lighthouse* rather than *The Waves*, noting, “Not only does Mrs. Ramsay exemplify all the qualities of a body in relative space-time . . . [but also] Mrs. Ramsay's capacity to stretch outside of herself expresses a philosophical standpoint that progresses beyond relativity.”¹⁶ In a similar vein, Brown suggests that in *To the Lighthouse*

the concordances between her father's understanding of perception and Einstein's understanding of space and time demonstrate why Woolf had an interest in relativity. Despite the interests and beliefs that Woolf shares with Stephen and Einstein, however, she overtly questions their shared presumption of subjects and objects that occupy distinct and impermeable locations.¹⁷

Both Banfield and Brown lay excellent foundations for understanding how *To the Lighthouse* incorporates and challenges modern physics, but neither speaks in depth about the ways in which *The Waves* may push these fictional experiments even further. Roebbelen's article does provide a cogent analysis of the ways in which *The Waves* integrates modern theories of physics, but rather than discussing how the novel may put pressure on these theories, it instead explains how the novel's assimilation of physics works to undermine British imperialism.

Woolf's explorations of spatial and temporal flux become fully evident for the first time in *To the Lighthouse*, published two years after Bohr and Heisenberg revolutionized quantum mechanics and four years before *The Waves*.¹⁸ In this earlier novel Woolf begins incorporating wavelike structures into the narrative, illuminating particular crests of action and plunging into a “trough” of time in which a decade contracts into a few moments.¹⁹ The character of Mrs. Ramsay presents a challenge to both the philosophy of Woolf's father (largely embodied by Mr. Ramsay) and to relativity, as she brings her guests into a moment of union around the dinner table which destabilizes bounded identities.²⁰ Mrs. Ramsay is also able to meld with others' personalities, to psychically embody the objects around her, and to fundamentally change the

“field” of waves/particles in her immediate presence.²¹ Woolf’s vision of reality thus diverges from relativity by challenging Einstein’s belief in stable, coherent objects. Insofar as the novel departs from notions of distinct, temporally situated objects, Woolf’s vision is in some ways closer to quantum mechanics than to relativity. Einstein took issue with quantum mechanics for “not directly dealing with reality in its basic architecture” and for “becoming increasingly abstract and losing intuitive contact with real experience.”²² Niels Bohr, on the other hand, had no qualms with the fact that quantum mechanics was a “probabilistic” system that could predict the *behavior* of subatomic particles, but could not describe their physical properties.²³ *To the Lighthouse* sides more with Bohr than Einstein, creating a world in which indeterminate boundaries between identities and objects are precisely the “intuitive contact with real experience” which her characters must negotiate.

In *The Waves*, the reader enters a fluctuating field of matter and consciousness midstream through the minds of six children in rural England. As they struggle to develop perceptual schemas, initially grounded in sensory experiences and observations, notions of self and other are problematized from the very beginning. Each child’s attempt to construct an identity through metaphor and comparison becomes fraught with overlaps and instabilities, and as the narrative circularly follows the children through the course of their lives, this ontological indeterminacy continues to haunt the characters and the narrative structure. In many ways, the novel proceeds from a relativistic to a quantum universe, as simultaneous reference points at first remain divided from one another and gradually become less so. As children, the six characters often perceive the same events but notice or focus on radically different aspects of them, and reality *is* how each of them sees it. Erica Roebbelen notes, “There is no privileged point of view or narrative stream in *The Waves* amongst the characters, but only an array of perspectives.” Near the end of the novel, the character named Bernard wonders, “Are there stories?” and begins to see the “facts” of narratives in a way that, Roebbelen writes, is “perhaps not so different from the conception of facts in twentieth-century physics.”²⁴

With the exception of purely descriptive interludes of natural imagery, as well as the occasional indicator of who is speaking, *The Waves* is composed entirely of six characters’ dialogues with one another and themselves. The form of the narrative, rising and falling in figurative language far removed from everyday speech, immediately cues the reader that something is out of the ordinary in this fictional universe. Though each of the six characters has

a unique perspective, there is no sense of a unifying consciousness that can synthesize these perspectives into a cohesive narrative, and although Bernard attempts to fill this role, he ends up with only “an unfinished phrase.”²⁵ There is also little or no sense of linear progression from one soliloquy to the next. This undermines the sense that the characters are even speaking to one another, and creates a sense of simultaneity, of six characters speaking at once. The soliloquies might easily be cut out and rearranged without significant loss of meaning, reflecting relativity’s contention that different perspectives may have equal claims to validity, but cannot add up to one particular story.²⁶

The novel also undermines the notion that the characters ever exist independently. While they have unique personalities and experiences, the similarities in their modes of expression create an impression of the same consciousness experiencing itself within six different bodies. Out of the formal homogeneity of the soliloquies a sense of ontological unity arises, “the impression of a mass mind individualized.”²⁷ This is particularly marked when they are children, as in the opening passage, in which they take turns describing the objects around them.

“I see a ring,” said Bernard, “hanging above me. It quivers and hangs in a loop of light.”

“I see a slab of pale yellow,” said Susan, “spreading away until it meets a purple stripe.”

“I hear a sound,” said Rhoda, “cheep, chirp; cheep, chirp; going up and down.”

“I see a globe,” said Neville, “hanging down in a drop against the enormous flanks of some hill.”

“I see a crimson tassel,” said Jinny, “twisted with gold threads.”

“I hear something stamping, said Louis. “A great beast’s foot is chained. It stamps, and stamps, and stamps.”²⁸

A sense of interchangeability arises from the similarity of their observations, and the individuality of the children becomes hazy. As their speeches continue, they also become increasingly complex and metaphorical, as in

“My roots go down to the depths of the world . . . Down there my eyes are the lidless eyes of a stone figure in a desert by the Nile”

“I am thrown over you like a net of light”

“I will take my anguish and lay it upon the roots under the beech trees.”²⁹

One begins to sense that these are children only in name, and that their bodies have become vehicles for a much larger field of consciousness. As their desires and attentions rise and fall, cohering and dissipating, their observations also begin to accumulate into a wavelike rhythm,

and as Harvena Richter notes, “It is perhaps significant that the rhythm of the waves—up and down, to and fro—is that universal pattern of systole and diastole which finds its rhythmic analogies in so many aspects of our emotional, biological, and physical life.”³⁰ These undulating rhythms give rise to a sense of life and consciousness as impersonal, turning the reader’s attention away from the individual speakers and toward the mechanisms of cognition that create the strings of words and thoughts. Their modes of expression are more simplistic during childhood than later on, but they remain highly stylized and artificial throughout the novel, creating an impression that each speaker is a manifestation of universal mental processes or even “the same mind,” as Richter puts it.³¹ Because the language of the characters sounds more like abstracted or disembodied consciousness than actual human speech, any sense of solidity in the characters’ existence is considerably undermined.³² Thus, reality is presented not merely as relative to one’s perspective, but as fundamentally indeterminate, since it may not even be possible to establish singular, coherent positions in space-time.

Through the parallels between the characters’ soliloquies and the artificiality of their speech, the prose gradually begins to morph into what Richter calls “supraconsciousness,” which challenges both relativity and quantum mechanics, not only in destabilizing identity but also in presenting minds as permeable, with consciousness passing between them.³³ Richter notes that “Virginia Woolf’s means of transition from mind to mind are frequently the same as from thought to thought, and so give the reader the impression that he remains, somehow, *within the same mind or a facet of it.*”³⁴ This fluidity of consciousness correlates to wave-particle duality, in which seemingly separate entities (in this case embodied personalities) become “flowing” and indeterminately bounded.³⁵ The characters’ alternating sensations of atomization and fluidity reflect the strange predicaments of a quantum universe in which the individual body is actually a flux of particles and waves. As each of them experiences intermittent wavelike expansions into the continuum of space-time, their “disembodied mood[s]” begin to seem closer to reality than their day-to-day experiences of separateness.³⁶ These “moments of being” are both frightening and liberating, because they bestow an increased sense of “wholeness” while simultaneously threatening annihilation of the self.³⁷ Some of the characters feel they are seeing things “without attachment, from the outside,” which allows them “to realise their beauty in itself,” while others are “conscious of flux, of disorder; of annihilation and despair.”³⁸ Although the characters long for “the complete human being whom we have failed to be,” they also desperately cling to the

stability of individual identities.³⁹ Lamenting, “We suffered terribly as we became separate bodies,” and “we who live in the body see with the body’s imagination things in outline,” they are nevertheless too afraid of death to remain in these states of “cosmic consciousness” for long.⁴⁰

In their essential fluidity, the six personalities impact and intermix with one another. By coming into proximity, they fundamentally change one another’s perceptions and senses of selfhood, correlating with Werner Heisenberg’s theory of “entanglement.”⁴¹ As the character named Rhoda observes a familiar teacher, Miss Lambert, she notes, “Wherever she goes, things are changed under her eyes; and yet when she has passed is not the thing the same again?” Similarly, Bernard wonders, “which of these people am I? It depends so much upon the room. When I say to myself, ‘Bernard,’ who comes?”⁴² In one scene, Bernard is sitting alone observing a willow tree, the leaves of which appear chaotic in reflection of his own untidy personality, but as soon as Neville approaches—whose habits are “neat as a cat”—the willow suddenly assumes “a combed look, each branch distinct.” Bernard remarks, “How strange . . . the willow looks seen together,” implying that in Neville’s presence he actually begins to see reality through the other’s eyes. Similarly, Neville observes: “As he approaches I become not myself but Neville mixed with somebody.” Both identity and perception thus become fluid, morphing with the approach of a familiar face, which is further underscored when Bernard offers to “create” Neville: “Let me then create you. (You have done as much for me.)” This suggests that one’s sense of self is not only affected by others but actually *generated* in relation or reaction to them. This is exemplified in moments in which the characters are experiencing “supraconsciousness” and the self suddenly coheres in the presence of a familiar face, which Bernard describes as being “contracted by another person into a single being.” Since personalities exist in a continuum, in which they both mirror and alter one another, “entanglement” often occurs as “Meeting and parting, we assemble different forms, make different patterns.”⁴³

The novel’s primary moment of ontological merging is the dinner scene with Percival. Percival’s character functions as a sort of mystical hub or god around which the lives of the other six characters revolve.⁴⁴ As a creature of the moment, he directly experiences life rather than attempting to control or analyze it, and cannot be bothered to ponder the nature of existence. Blissfully unaware of the desperate attempts of the others to carve out cohesive identities, he rises above their existential crises to create an atmosphere of stability and

wholeness. As in physics with the approach of a large mass, when Percival approaches time slows and objects “undergo an extraordinary transformation.”⁴⁵ The others feel that “without Percival there is no solidity. We are silhouettes, hollow phantoms moving mistily without a background.”⁴⁶ In the dinner scene he becomes the centerpiece of their experiences, and they feel themselves becoming a “complete human being” through the “solidity” of his body, which transforms into geometric figures under their collective gaze.⁴⁷ They perceive that “Percival is become a six-sided flower; made of six lives,” following which his/their body becomes a “globe whose walls are made of Percival.”⁴⁸

This scene illustrates Woolf’s maturing vision of reality. It marks a significant change from the “Boeuf en Daube” dinner of *To the Lighthouse*, in which Mrs. Ramsay creates “from such moments . . . the thing . . . that endures.”⁴⁹ By contrast, in the dinner with Percival, “We have come together . . . to make one thing, not enduring—for what endures?—but seen by many eyes simultaneously.”⁵⁰ In the world of Mrs. Ramsay, “the thing . . . that endures” represents a visionary transcendence of reality, in which she is able to coalesce the moment into a solid psychic object that she can “detach,” “separate,” and “hold . . . before her.”⁵¹ *The Waves* suggests that no such object exists, only simultaneous perspectives of the “globe” they collectively create. Rather than creating out of the moment something that will endure, they create a psychic superstructure composed of the sum of their perspectives. A totalizing “vision” of the moment not only cannot endure—it cannot exist. Though created out of their “communion” in “some deep, some common emotion,” the moment can be apprehended and inhabited only as a multiplicity of felt experiences.⁵²

In addition to becoming an object of simultaneous perception, their “many-sided substance . . . [or] many-faceted flower” also becomes a symbol for the geometrization of space.⁵³ As Miller asserts in *Einstein, Picasso*, just as “special relativity could be fully generalized only through geometrization,” modern artists such as Picasso and Braque realized that geometrization comes closer to the “deep structure” of reality than mimetic modes of representation, and “Geometry had to become the language of the new art.”⁵⁴ Similarly, the space of *The Waves* becomes largely geometrized, particularly in the semi-hallucinatory visions of Rhoda, who equates “a world immune from change” with geometric shapes, which form a “perfect dwelling-place” in which “Very little is left outside.”⁵⁵ Though somewhat cryptic, her perception seems to be that their “many-sided substance carved out of this darkness”

corresponds to relativity's use of geometric models to account for objects in space.⁵⁶ Just as physics represents subatomic particles through abstract diagrams, seeing structures in geometric terms allows one to make "visible" their deeper essence.⁵⁷ The quasi-Cubist "many-sided flower" of their "communion" gives Rhoda a sense of stability by representing an underlying order, a "world immune from change," and becomes a secure "dwelling-place" within the geometry of the universe.⁵⁸ In a similar moment, the transformation of objects into lines and shapes not only makes their deep structures visible but also effaces distinctions: Bernard notes "how dots and dashes are beginning, as I walk, to run themselves into continuous lines, how things are losing the bald, the separate identity that they had . . . The great red pot is now a reddish streak in a wave of yellowish green."⁵⁹ Just as Lily Briscoe, the artist-heroine of *To the Lighthouse*, creates an abstract painting in which "objects of universal veneration" are rendered in their essence as a "triangular purple shape," Bernard comes closer to an awareness of reality by seeing the world as "blobs of undifferentiated matter."⁶⁰ The characters of *The Waves* also become geometric entities, the mirroring of each of their soliloquies creating an impression of multiple selves or facets existing simultaneously within each body. As Richter notes, Woolf creates "a multi-dimensional effect in character, a sort of prism-sightedness," in which the characters exist more as incomplete fragments than as cohesive beings, each contributing a piece to the "complete human being whom we have failed to be," not unlike objects in a Cubist painting.⁶¹

In a moment that parallels the psychic communion of the dinner scene, Bernard and Neville share an experience in which time is perceived inter-subjectively. Sitting together in an abstracted state, they shed all sense of objects as separate and solid, including their own bodies, and exist in a bubble of atemporal consciousness. It is only when Neville stirs the fire that they are recalled to a sense of clock time and to the recognition of their isolated bodies. As their state of collective consciousness ruptures, and both return to their fixed identities, Bernard immediately registers the return of his everyday perceptions, noting that

suddenly one hears a clock tick. We who had been immersed in this world become aware of another. It is painful. It was Neville who changed our time. He who had been thinking with the unlimited time of the mind, which stretches in a flash from Shakespeare to ourselves, poked the fire and began to live by that other clock which marks the approach of a particular person.⁶²

As Neville picks up the poker, an ostensibly solid object, their state of collective reverie lapses and they fall back into the world of familiar perceptions. Dislodged from the heights of

intellectual abstraction, in which they had experienced “the unlimited time of the mind,” reality contracts into a small room containing two aging, separate bodies. As clock time reasserts itself, space also solidifies: “The folds of the curtain became still, statuesque; the paper-weight on the table hardened; the threads of the curtain sparkled; everything become definite, external, a scene in which I had no part.”⁶³ The sudden loss of cosmic consciousness is “painful” because it is a return to the world of illusory separateness, in which one feels external to the “scene” of life rather than inextricably bound up with it. The two men are left suddenly isolated, observing one another from either side of an unbridgeable chasm. This disruption of deeper states of awareness by tactile sensations is a key problem in *The Waves*, as one’s sense of immersion in reality cannot easily coexist with the world of solid, discrete objects.⁶⁴

Tactile knowledge is itself questioned in a later scene in which Bernard reflects, “I begin now to forget; I begin to doubt the fixity of tables, the reality of here and now, to tap my knuckles smartly upon the edges of apparently solid objects and say, ‘Are you hard?’”⁶⁵ Ann Banfield notes that as “the paradigmatic object of knowledge in the history of English thought,” the table becomes a central image in Woolf’s novels for “the problem of knowledge.”⁶⁶ In Woolf’s philosophy, a table is neither hard nor separate, nor can it be said to exist at all. In Brown’s discussion of *To the Lighthouse*, he notes:

Mr. Ramsay’s table exists independently of its observation, whereas Mrs. Ramsay’s table is a participatory “object,” interacting and changing with the forces of her consciousness. Mrs. Ramsay has a holistic relationship to the world around her, which confounds the notion that subjects and objects are specifically located and bounded.⁶⁷

Everyday perceptions of “bounded” objects become increasingly uncertain in both *To the Lighthouse* and *The Waves* as Woolf’s characters pass in and out of states of collective awareness. By the end of *The Waves*, Bernard begins to question the “fixity” of physical space even while he experiences it, and contact with solid, familiar objects is no longer enough to convince him of their existence. As the novel’s six characters fluctuate between particulate and wavelike experiences of reality, the jarring discontinuities between unification and separation make it difficult for them to exist definitively in either state, and in the end this tension remains unresolved. In the universe posited by *The Waves*, however, the final merging of the isolated self into a “participatory” state of supraconsciousness does at least become a possibility for these characters.

It is this notion of a “participatory” reality (Brown alludes to this above) which ultimately distinguishes Woolf’s view of reality from those of her contemporaries. Unlike other early-twentieth-century models, *The Waves* presents space-time not only as a state of flux, but also as an interpenetrating psychic medium. The characters in both *To the Lighthouse* and *The Waves* become capable of transforming and intermingling with the people and objects in their “fields” through immersions of cosmic consciousness, a potential denied by relativity and quantum mechanics. As Brown notes, “In contrast to the fields of physics, Woolf’s characters are bound to one another and to the world via their consciousness . . . [and] direct connections between individuals and individuals and objects appear to be made possible through the mind.”⁶⁸ Neither their bodies nor their minds exist independently, and reality thus becomes a co-creation of personalities and relationships between objects and fields in space-time. In this way Woolf pushes beyond both relativity and quantum theory, positing a world in which the indeterminate implications of relativity, wave-particle duality, and entanglement carry over into the realm of the mind.

Woolf’s presentation of consciousness as a collective medium is also the most paradoxical aspect of her vision. If, as Rhoda asserts, reality is a “world immune from change,” a continuum of undifferentiated matter and energy, how can it also be a psychic field in which one participates and effects change? *The Waves* appears to argue that reality is both an unchanging order and a fluid, wavelike substance that one participates in shaping. On one hand, it seems that nothing can alter the wavelike, oceanic nature of the universe—new forms may arise and fall, but the underlying order remains constant. On the other hand, it also appears to be a universe composed simultaneously of particles and waves, in which objects become indeterminately entangled with one another, hardly an image of permanence and stability. In Woolf’s earlier-discussed essay “Modern Fiction” she also poses the question of whether consciousness “embraces or creates what is outside itself or beyond.”⁶⁹ Several critics have noted the vast distinction between a self that “embraces” reality and one that actually “creates” it, and Brown notes that “the words ‘embraces’ and ‘creates’ are something of a problem, since they postulate two different attitudes toward what is outside. Is the world around us an ultimate order which we can ‘embrace’ by somehow getting outside the ego, or is it a chaos out of which we ‘create’ order through the effort of imagination?”⁷⁰ This paradox does not represent a failing on Woolf’s part, but rather her nuanced understanding of the contradictions inherent in modernist

depictions of the universe. In *The Waves*, one can never say what reality is because its most basic components behave unpredictably and elude all definitions. Woolf would probably add that it is the imagination rather than the rational mind that one needs to contemplate the nature of reality, since sensory perceptions lead to illusions of solid, separate objects. As Brown succinctly notes, “Woolf seems to advocate the simultaneity of creating and embracing as the best way of describing existence.”⁷¹ Woolf seems to recognize that the closest one can come to representing the nature of reality is to take these contradictions into account without attempting to artificially reconcile them. Moreover, she takes advantage of the fact that in such an indeterminate universe, consciousness may also exist in a state of flux, and thus individual minds may become part of an oceanic consciousness, both embodied as particles and dispersed throughout existence as waves. As the physicist Sir James Jeans has it, “The universe begins to look more like a great thought than a great machine,” and as Bernard says in *The Waves*, “There is no stability in this world. . . . To speak of knowledge is futile. All is experiment and adventure. We are for ever mixing ourselves with unknown quantities. What is to come? I know not.”⁷²

Notes

¹ See Christine Froula’s discussion of a “reality beyond appearances” in Virginia Woolf’s fiction. Christine Froula, *Virginia Woolf and the Bloomsbury Avant-garde: War, Civilization, Modernity* (New York: Columbia University Press, 2005), 142. Miller notes, “The age-old quest of both art and science has been to seek new representations of phenomena beyond appearances.” Arthur I. Miller, *Einstein, Picasso: Space, Time, and the Beauty That Causes Havoc* (New York: Basic Books, 2001), 6.

² Miller, *Einstein, Picasso*, 227; also, Roger G. Newton, *How Physics Confronts Reality: Einstein Was Correct, but Bohr Won the Game* (London: World Scientific Publishing Co., 2009), 16.

³ Miller, *Einstein, Picasso*, 208.

⁴ As Harvena Richter argues, “Time for Virginia Woolf was not measured by the clock but experienced emotionally—hence her phrase ‘moment of being.’” Harvena Richter, *Virginia Woolf: The Inward Voyage* (Princeton: Princeton University Press, 1970), 38. The contraction occurs in the “Time Passes” section of *To the Lighthouse* and in the “troughs” between moments in *The Waves*.

⁵ Virginia Woolf, *Jacob’s Room and The Waves: Two Complete Novels* (New York: Harcourt, Brace, and World, 1959), 177; Richter, *The Inward Voyage*, 53.

⁶ Many critics of *To the Lighthouse* and *The Waves* have explored the ways in which these novels incorporate wave imagery and wave-like phenomena. One of the most insightful readings of *The Waves* is Harvena Richter's account in *The Inward Voyage*, 59, 117. She refers to the world of *The Waves* as a "submarine cave" in which identities become submerged and form an oceanic "unified though various whole." In "The Seen and the Unseen: Virginia Woolf's *To the Lighthouse*" (Cambridge: Harvard University Press, 1977), 11-13, Lisa Ruddick reads Woolf's waves as the shifting surface of consciousness, beneath which roils an immensely deep subconscious realm that converges with reality at the moment of death, when one enigmatically reaches the ocean floor. Ruddick interprets Woolf's "platform of stability" in *To the Lighthouse* as "the floor of a churning sea . . . the word 'beauty' is reserved in Woolf for those moments of vision that reveal the peaceful, immutable ocean bottom beneath," and she also asserts that "the entropy which means unity, tranquility, and beauty for the world as a whole means dissolution and death for the individual." Ruddick also interprets the journey over water to the lighthouse in terms of *distance*, as a critical reorienting of perspective in which what was near becomes far, and in which physical objects in the distance begin to blend and become ontologically indistinguishable; likewise, with the return back to shore, the lighthouse once again loses its stony solidity and fades into the distance until it becomes a metaphor for perception itself, the body that sheds an illuminating inner consciousness on the world it scans. Richter, Ruddick, and many others read Woolf's waves variously—as the conscious mind, the implacable rhythms of nature, the erosions of time, or the frontier one crosses to reach visionary perspectives.

⁷ While Woolf's explorations of time in *The Waves* reflect and challenge Einstein's theories, her depictions of objects in flux echo both wave-particle duality and the notion of "entanglement," a theory that was not formalized until four years after the novel's publication in 1931. (See p. 10, footnote 27 for description of entanglement).

⁸ Paul Tolliver Brown asserts, "Understanding the similarities between Woolf's characters and their beliefs and the epistemological problems faced by early twentieth-century physicists proves insightful, but it is equally important to recognize their differences. These distinctions indicate the uniqueness of Woolf's own particular vision." Paul Tolliver Brown, "Relativity, Quantum Physics, and Consciousness in Virginia Woolf's *To the Lighthouse*," *Journal of Modern Literature* (Spring 2009): 53.

⁹ Articulated most famously in Bergson's *Matière et mémoire: essai sur la relation du corps à l'esprit* (Paris: F. Alcan, 1896). In *The Inward Voyage*, Harvena Richter argues that "Although Mrs. Woolf did not consciously follow Bergson, her moment of being, with its diversity in unity, resembles his concept of duration (*la durée*) in which time is qualitative, nonspatial, real, vertical, and always present." Richter, *The Inward Voyage*, 39.

¹⁰ Richter reflects, "Virginia Woolf . . . possibly under the influence of Hume and G. E. Moore, seemed to consider the object in a subjective manner, as shaped by an individual's thoughts, memories, and sensations. In other words, *it is the emotional experience of the object, rather than the object itself, which is known.*" Richter, *The Inward Voyage*, 67. In *The Phantom Table*, Ann Banfield also argues that Woolf's acquaintance, Bertrand Russell, had a significant impact on her work. In his own *Analysis of Matter* (New York: Dover Publications, 1954), Russell writes, "the world of physics is, *prima facie*, so different from the world of perception that it is difficult to see how one can afford evidence for the other." Ann Banfield, *The Phantom Table: Woolf, Fry, Russell, and Epistemology of Modernism* (Cambridge: Cambridge University Press, 2000), 6.

¹¹ Richter, *The Inward Voyage*, 38.

¹² Leslie Stephen, *An Agnostic's Apology and Other Essays*, 2nd ed. (London: Smith, Elder, and Co., 1903), 135. Stephen also states: “‘This is a table’ is a phrase which in the first place asserts that I have a certain set of organised sense-impressions. But it also means that you have an analogous set of impressions, and that if we changed places we should also change sensations. It is a compact formula, which not only indicates the sensations of an observer at a particular time and place, but also gives the sensations of every other observer as those which would be perceived by the same observer at other times and places.” *Ibid.*, 137–138.

¹³ Russell, a close acquaintance of Woolf's, was well-versed in relativity theory, and wrote a book called *The ABC of Relativity*. Bertrand Russell, *The ABC of Relativity*, 3rd rev.ed. (London: Allen and Unwin, 1969).

¹⁴ Virginia Woolf, *A Room of One's Own* (San Diego, CA: Harcourt, Brace, Jovanovich, 1929), 21.

¹⁵ Virginia Woolf, “Modern Fiction,” in *The Essays of Virginia Woolf*, vol. 3 1919–1924, ed. Andrew McNeillie (New York: Harcourt, Brace, Jovanovich, 1988), 34, 33.

¹⁶ Banfield, *The Phantom Table*, 49. Earlier publications include Judith Killen's 1984 dissertation, “Virginia Woolf in the Light of Modern Physics” (Kentucky: University of Louisville); Mark Hussey's 1995 article, “*To the Lighthouse* and Physics: The Cosmology of David Bohm and Virginia Woolf” (Dallas: Contemporary Research Press); and Gillian Beer's 1996 book, *Virginia Woolf: The Common Ground* (Ann Arbor: University of Michigan Press).

¹⁷ Brown, “Quantum Physics,” 48.

¹⁸ Newton observes that the advent of what we now know as quantum mechanics “implied a profound alteration in the way the state of a physical system was described. Whereas in classical mechanics the state of a system of particles at a given time was described by specifying the positions and momenta of each of the particles at that time, in quantum mechanics that state was described by the probability of detecting them in certain positions, as well as the probabilities of the outcomes of other measurements. It made no reference to the positions or momenta of the particles themselves at all.” Newton, *How Physics Confronts Reality*, 20; also see 132.

¹⁹ Virginia Woolf, *To the Lighthouse* (New York: Harcourt, 1981), 125-144.

²⁰ Woolf writes that *To the Lighthouse* would “have father's character done complete in it,” and the philosopher Mr. Ramsay closely parallels her father, Leslie Stephen [*The Diary of Virginia Woolf*, vol. 3, 1925–1930, ed. Anne Oliver Bell, assisted by Andrew McNeillie (New York: Harcourt, Brace, Jovanovich, 1980), 18].

Brown argues, “The difference between Woolf's viewpoint and that of her father and Einstein makes itself apparent through the contrast between the table as an object of permeability and connectivity versus the table as an object of independence and separation.” Brown, “Quantum Physics,” 47.

²¹ Brown notes that “Mrs. Ramsay's attractive force has a similar effect to that of gravity on the temporal dimension as well as the spatial. She has the capacity to slow time until the moment can crystallize.” Brown, “Quantum Physics,” 45.

²² Newton, *How Physics Confronts Reality*, 3.

²³ Ibid., 13.

²⁴ Woolf, *The Waves*, 306; Erica Roebbelen, “Manifestations of Twentieth-Century in Virginia Woolf’s *The Waves*: Undermining the Ideological Foundations of the British Imperial Project.” *Erudito Journal* February 2010: 94.

²⁵ Woolf, *The Waves*, 373.

²⁶ In *Einstein, Picasso*, 226, Miller explains that according to relativity there is “no such thing as a true length,” and that if “length is a relative quantity,” this effectively “eliminat[es] from physics the notion of a preferred reference point.”

²⁷ Richter, *The Inward Voyage*, 53.

²⁸ Woolf, *The Waves*, 180.

²⁹ Ibid., 182; 183.

³⁰ Richter, *The Inward Voyage*, 241.

³¹ Ibid., 42.

³² Woolf, *The Waves*, 221.

³³ Richter, *The Inward Voyage*, 41. The relationship between the mind and quantum waves is also discussed by Gaston Bachelard in the “Rhythmanalysis” section of his *La dialectique de la durée* (Paris: Boivin, 1936).

Here I am distinguishing these characters’ interchanges from “normal” human interactions, in which one’s behavior is always influenced by others. Woolf’s characters, I argue, do not merely “affect” one another. They are actually *made up of* each other, stepping in and out of one another’s consciousness and essentially *effecting* (giving rise to) one another. Their “supraconsciousness” lacks clear edges—it is both particulate and wavelike.

³⁴ Richter, *The Inward Voyage*, 52.

³⁵ Woolf, *The Waves*, 200.

³⁶ Ibid., 335.

³⁷ Richter, *The Inward Voyage*, 46, 60; Brown quotes David Bohm’s explanation of how quantum theory departs from relativity: “One is led to a new notion of unbroken wholeness which denies the classical idea of analyzability of the world into separate and independently existing parts . . . we have reversed the usual classical notion that independent ‘elementary parts’ of the whole are the fundamental reality and that the various systems are merely the particular contingent forms and arrangements of these parts. Rather we say that the inseparable quantum interconnectedness of the whole universe is the fundamental reality, and that relatively independently behaving parts are merely particular and contingent forms within the whole.” David Bohm and Basil Hiley, “On the Intuitive Understanding of Nonlocality as Implied by Quantum Theory,” *Foundations of Physics* 5, no. 1 (1975): 93–109, in Brown, “Quantum Physics,” 50–51.

³⁸ Woolf, *The Waves*, 359, 239.

³⁹ Ibid., 369.

⁴⁰ Ibid., 344, 297; Brown, “Quantum Physics,” 53.

⁴¹ Brown notes, “Entanglement occurs when two or more subatomic particles interact with one another under certain conditions and their fates become intertwined. Whatever happens to one instantaneously affects the other, no matter how spatially separated they may be in the universe.” Brown, “Quantum Physics,” 56.

⁴² Woolf, *The Waves*, 230.

⁴³ All quotations in this paragraph are from *The Waves*, pp. 300, 232 (three quotations), 233, 236, and 293, in order of citation.

⁴⁴ Ibid., 269.

⁴⁵ Woolf, *The Waves*, 257. Brown quotes Stephen Hawking, who observes, “[a] prediction of general relativity is that time should appear to run slower near a massive body.” Stephen Hawking, *A Brief History of Time: From the Big Bang to Black Holes* (New York: Bantam Books, 1988), 33, in Brown, “Quantum Physics,” 40.

⁴⁶ Woolf, *The Waves*, 259.

⁴⁷ Ibid., 369.

⁴⁸ Ibid., 335, 276.

⁴⁹ Woolf, *To the Lighthouse*, 103.

⁵⁰ Woolf, *The Waves*, 263.

⁵¹ Woolf, *To the Lighthouse*, 110.

⁵² Woolf, *The Waves*, 263.

⁵³ Ibid., 335.

⁵⁴ Miller, *Einstein, Picasso*, 219, 240.

⁵⁵ Woolf, *The Waves*, 288.

⁵⁶ Ibid., 335.

⁵⁷ Rhoda notes, “The structure is now visible; what is inchoate is here stated; we are not so various or mean; we have made oblongs and stood them upon squares. This is our triumph; this is our consolation.” Ibid., 288.

⁵⁸ Ibid., 263, 249.

⁵⁹ Ibid., 306.

⁶⁰ Woolf, *To the Lighthouse*, 50; *The Waves*, 347.

⁶¹ Richter, *Inward Voyage*, 113, 369.

⁶² Woolf, *The Waves*, 366.

⁶³ Ibid., 367.

⁶⁴ Richter explains that the “confining of her world to that of sight . . . makes possible the existence of the object as a mirror-image of the self. Were the tactile sense fused with the visual, the object as mirror would be impossible, for touch validates the existence of a knowable world beyond that of the self.” Richter, *Inward Voyage*, 69.

⁶⁵ Woolf, *The Waves*, 377.

⁶⁶ Banfield, *The Phantom Table*, 66, 49.

⁶⁷ Brown, “Quantum Physics,” 48.

⁶⁸ Ibid., 53.

⁶⁹ Woolf, “Modern Fiction,” 34.

⁷⁰ Brown, “Quantum Physics,” 74.

⁷¹ Ibid., 53.

⁷² James Jeans, *The Mysterious Universe* (Cambridge: Cambridge University Press, 1930), 139; Woolf, *The Waves*, 256. Jane Marcus mentions a connection between Jeans and Woolf, noting, “Throughout December 1930, when she was revising *The Waves*, Woolf was reading and discussing Sir James Jeans’s books and listening to his lectures on the radio.” Jane Marcus, “Britannia Rules *The Waves*,” *Decolonizing Tradition: New Views of Twentieth-Century ‘British’ Canons*, ed. Karen R. Lawrence (Urbana: University of Illinois Press, 1992), 160.

Works Cited

Banfield, Ann. *The Phantom Table: Woolf, Fry, Russell, and Epistemology of Modernism*. Cambridge: Cambridge University Press, 2000.

Brown, Paul Tolliver. “Relativity, Quantum Physics, and Consciousness in Virginia Woolf’s *To the Lighthouse*.” *Journal of Modern Literature* Spring 2009: 39-62.

-
- Froula, Christine. *Virginia Woolf and the Bloomsbury Avant-garde: War, Civilization, Modernity*. New York: Columbia University Press, 2005.
- Jeans, James. *The Mysterious Universe*. Cambridge: Cambridge University Press, 1930.
- Marcus, Jane. "Britannia Rules *The Waves*." *Decolonizing Tradition: New Views of Twentieth-Century British' Canons*. Edited by Karen R. Lawrence. Urbana: University of Illinois Press, 1992: 136-62.
- Miller, Arthur I. *Einstein, Picasso: Space, Time, and the Beauty That Causes Havoc*. New York: Basic Books, 2001.
- Richter, Harvena. *Virginia Woolf: The Inward Voyage*. Princeton: Princeton University Press, 1970.
- Roebelen, Erica. "Manifestations of Twentieth-Century Physics in Virginia Woolf's *The Waves*: Undermining the Ideological Foundations of the British Imperial Project." *Erudito Journal* February 2010: 94.
- Ruddick, Lisa. "The Seen and the Unseen: Virginia Woolf's *To the Lighthouse*." Cambridge: Harvard University Press, 1977.
- Russell, Bertrand. *Analysis of Matter*. New York: Harcourt, Brace and Company, 1927.
- Stephen, Leslie. *An Agnostic's Apology and Other Essays*. 2nd ed. London: Smith, Elder, and Co., 1903.
- Woolf, Virginia. *A Room of One's Own*. San Diego, CA: Harcourt, Brace, Jovanovich, 1929.
- . *Jacob's Room and the Waves: Two Complete Novels*. New York: Harcourt, Brace, and World, 1959.
- . *The Diary of Virginia Woolf*. Edited by Anne Oliver Bell, assisted by Andrew McNeillie. Vol. 3, 1925–1930. New York: Harcourt Brace Jovanovich, 1980.
- . *To the Lighthouse*. New York: Harcourt, 1981.
- . "Modern Novels." *The Essays of Virginia Woolf*. Edited by Andrew McNeillie. Vol. 3, 1919–1924. New York: Harcourt Brace Jovanovich, 1988.