From Parallel Universes to Possible Worlds: Ontological Pluralism in Physics, Narratology, and Narrative

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Abstract This essay explores how theoretical physics, narratology, and narrative itself deal with the idea that reality consists of a plurality of worlds. In physics, the existence of parallel universes has been postulated on the cosmic level to describe what lies on the other side of black holes and, on the level of subatomic particles, to avoid the paradoxes of quantum mechanics. In narratology, the philosophical idea of a plurality of possible worlds and the contrast between the actual and the possible provide a model of the cognitive pattern into which readers organize information in order to interpret it as a story. But the many-worlds interpretation of physics and the possible worlds (PW) model of narrative differ in their conception of the ontological status of the multiple worlds: in physics they are all actual, while narrative theory stresses the contrast between actuality and mere possibility. This does not mean that the PW model is incompatible with the many-worlds cosmology proposed by physics: faced with a narrative that presents multiple realities as existing objectively, the theory would simply claim that the actual domain is made up of a number of different worlds and that the distinction actual/nonactual repeats itself within each of these parts. The last section of the essay explores what it takes for a narrative to impose a many-worlds cosmology, distinguishing these narratives from other texts that present contradictory versions of facts and situating them with respect to three types of story common in fantasy and science fiction: the narrative of transworld exploration, the narrative of alternate history, and the time-travel narrative.

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The idea that reality—the sum total of what exists—may include other worlds than the world that we experience every day ranks near the very top of the topics that fascinate the human mind. We find its manifestations in a wide variety of fields: in medieval cartography, with the representations of fantastic creatures in the terrae incognitae that lie beyond the limits of the known world (Brown 1977 [1949]); in philosophy, with Leibniz's doctrine of the monads (Rescher 1991); in logic, with the postulation of possible worlds to define the truth conditions of modal operators and counterfactuals (Kripke 1963; Lewis 1973); in technology, with the hype that surrounded the development of virtual reality (Ryan 2001), a hype fueled by the hope that the computer could physically transport us into alternate realities; and, of course, in literature and the visual arts, which did not await the development of science fiction to produce a steady stream of foreign worlds. Last but not least, the idea of multiple realities has made its way into theoretical physics and narrative theory. In the first two parts of this essay, I compare and contrast how these two disciplines conceive ontological puralism; in the third part, I explore how narrative fiction deals with the notion of a multiverse composed of parallel worlds.

Multiple Realities in Physics

In physics, the idea of multiple realities is known as the "parallel universes" or as the "many-worlds" interpretation. (*World* and *universe* are used interchangeably.) This interpretation is extremely controversial in the physics community, and many eminent scientists—for instance, the late Irish physicist John S. Bell (1989) or the respected science writer Martin Gardner (2001)—find it completely absurd; but it has recently received a lot of publicity in books and journals of scientific popularization. In my presentation of the notion of parallel universes, I will follow a taxonomy proposed by Max Tegmark (2003) in *Scientific American*, but I will also rely on work by other authors in my discussions of the individual categories. Tegmark distinguishes four types of parallel universes, which he associates with four "levels" of the multiverse, the global scheme that encompasses everything that exists. Though Tegmark does not explain the rationale of his ordering of levels, it seems that the higher the level, the more improbable it is that human beings will ever visit its worlds.[1]

1. If it were not for the third level, one could also say that the higher the level, the more adjustments are needed in the laws of physics compared to the laws of our world. But level 3 requires no adjustments, as we will see below.

Level 1

The postulation of parallel universes of level 1 rests on three assumptions: (1) Space (or rather, the space that extends along the three "classical" dimensions)[2] is infinite. (2) The observable universe, known as "Hubble space" to astronomers, is limited in size. (3) Matter is not limited to the observable universe. It follows that the outer regions of space could be teeming with galaxies, stars, and planets or, in other words, with parallel universes. "According to current theories," writes Tegmark (2003: 42), "processes early in the big bang spread matter around with a degree of randomness, generating all possible arrangements with non-zero probability." But if space is infinite, it has room for more than all the different possible combinations of elementary particles that make up the observable universe. There is consequently a good chance that the combination that describes our universe is realized more than once and that we have counterparts of ourselves somewhere in the multiverse. There will also be close copies of our universe in which our counterparts undergo a different fate. According to Tegmark, the multiple universes of level 1 all follow the same laws of physics, but they differ in their initial conditions. They may also travel at different speeds in time and space. Our doppelgängers in the exact copies of our universe may, for instance, already have experienced the year 2020.[3]

Level 2

While parallel universes of level 1 exist in the same time and space as our universe, those of level 2 are found in alternate spaces. These alternate spaces develop as the result of irregularities in the stretching of space that has continually been taking place since the Big Bang. According to Tegmark, some regions stop stretching and form bubbles; when these bubbles burst, they give rise to a new level 1 multiverse, complete with its multiple

2. Superstring theory postulates more than three space dimensions (nine or ten), but the additional dimensions are tightly curled up rather than infinite (Greene 1999).

3. The philosopher David Lewis, known as the champion of modal realism (see below), would have problems with Tegmark's conception of a universe as "that which can be observed" and with his attribution of what lies beyond it in the same space-time to parallel universes. For Lewis (1986b: 70–71), universes (or worlds, as he calls them) extend in space and time. For instance, if Mars is inhabited, its inhabitants are part of the same Lewis world as Elvis Presley, and Elvis is part of the same world as Napoleon, Genghis Khan, and dinosaurs, even though their lifetimes did not overlap. Insofar as Tegmark's parallel universes of level 1 belong to the same spatiotemporal frame as the observable universe, Lewis would regard them as the unknown extension of that universe. In other words, for Lewis, truly parallel universes exist in different space-times. But even if all the planets, stars, and galaxies belonged to the same universe, there would be such an astronomical number of them that duplicate entities would likely be found within space-time. Tegmark (2003: 42) foresees this possibility even for his limited-space universes: "Your nearest Doppelgänger may be closer to you [than the next universe]. Astronomers suggest that our Hubble volume has at least 10^{20} habitable planets; some might well look like Earth."

parallel universes. Level 2 universes consequently presuppose a process of recursive embedding within the fabric of space. Brian Greene (1999: 369) attributes this recursive embedding to the effect of black holes, those celestial objects whose gravitational fields are so intense that they entrap everything that comes close: "Every black hole is the seed for a new universe that erupts into existence like a big bang–like explosion, but is forever hidden from our view by the black hole's event horizon." Both Greene and Tegmark agree that the universes that come into existence as a result of such violent events within the fabric of space may differ from those of level 1 in much more radical ways than level 1 universes differ among themselves. Greene suggests that they may have a different number of elementary particles or that their spaces may have a different number of dimensions, while Tegmark believes that they may differ in the value of constants but follow the "same" laws of physics: you just plug different numbers into the same equations.

For the cosmic imagination, a particularly appealing consequence of the idea of multiple universes that spring out of black holes or spatial bubbles is its reconciliation of two competing answers to the fundamental ontological question: why is there something rather than nothing. In one mythical tradition (for instance, the biblical story of creation), the universe is created ex nihilo and once and for all at the beginning of time; in the other (Buddhist cosmology), it always existed. The existence of multiple universes on level 2 blends these two models by presenting creation as an endlessly repeatable event. As Michio Kaku (2005: 93) observes: "In this theory, spontaneous breaking may occur anywhere within our universe, allowing an entire universe to bud off our universe. It also means that our universe may have budded from a previous universe. In the chaotic inflationary model, the multiverse is eternal, even if the individual universes are not."

Level 4

But what if parallel universes followed entirely different laws? Tegmark makes room for this possibility in his level 4 universes, which I describe here before those of type 3, because I want to end up with the type that plays the most revolutionary role in theoretical physics. Universes of level 4 are the products of a thought experiment based on the belief that there is no absolute necessity for the laws of physics to be the way they are. "How about a universe," asks Tegmark (2003: 49), "that obeys the laws of classical physics, with no quantum effects?[4] How about time that comes in dis-

4. This remark reflects the fact that theoretical physics has so far been unable to reconcile classical physics, i.e., the laws that apply to large bodies of matter, with quantum mechanics, the behavior of subatomic particles. (I return to this below.)

crete steps, as for computers, instead of being continuous? How about a universe that is simply an empty dodecahedron?" Adopting a Platonic view, by which mathematical structures embody "the ultimate reality," Tegmark suggests that level 4 universes are the realizations of all the structures that can be mathematically described. The only laws that level 4 universes cannot breach are those of mathematical logic, such as excluded middle and noncontradiction. "If the universe is inherently mathematical," asks Tegmark, "then why was only one of the many mathematical structures singled out to describe our universe?" (ibid.: 50). Leibniz would have said that God chose the best (most elegant, most harmonious) of these structures, and Brian Greene (1999: 368) and David Deutsch (1997: 135) have suggested that our laws of physics are the only ones that allow the emergence of intelligent life and consequently of minds capable of understanding them. (Deutsch goes as far as to claim that, by producing life, the laws of physics "mandate their own comprehensibility.") Tegmark defends another view: all mathematical structures exist physically as well, but since mathematical structures are not the sort of entities that reside in space and time, neither do some of the universes that they describe. This leaves Tegmark's reader to figure out how physics and physical existence can be divorced from space and time—a problem that involves some of the most vexing philosophical questions: the nature of time, space, and matter.

Level 3

The last type of parallel universes postulated by physicists concerns the notoriously strange phenomena that take place on the subatomic level—those of quantum mechanics. In contrast to the worlds of levels 2 and 4, the so-called "many-worlds interpretation" of quantum phenomena does not presuppose any modification of the laws of physics. "It is ironic," writes Tegmark (2003: 51), "that level 3 is the one that has drawn the most fire in the past decade, because it is the only one that adds no qualitatively new types of universes."

The many-worlds interpretation of quantum physics is an attempt to deal with the well-established fact that the behavior of subatomic particles, such as electrons, cannot be predicted with absolute certainty. As Greene (1999: 107) writes, "If a particular experiment involving an electron is repeated over and over again in an absolutely identical manner, the same answer for, say, the measured position of an electron will *not* be found over and over again." We can determine the probability of an electron (or any other kind of subatomic particle) being found in a specific location, but we cannot predict which one of these possibilities will be actualized. Such probabilities are predicted by using a mathematical object known as the wave *function*

of the particle, and it is captured, for the electron, by the famous Schrödinger equation.[5] Through this notion of wave function, quantum physics presents an inherent affinity with the notion of multiple possible worlds. As Claes Åberg (1989: 381) puts it, "quantum mechanics is a theory of potentialities—not of actualities . . . a theory of possible worlds—not of the actual world."

Yet this focus on the potential is not in itself sufficient to make quantum mechanics into a theory of multiple parallel universes, because, of all the possible positions or trajectories of the electron, only one will be realized. Or at least this is the orthodox interpretation, generally associated with Niels Bohr and the Copenhagen school of quantum mechanics. According to the so-called Copenhagen interpretation,[6] the wave function collapses when an observation is made, so that each elementary particle will be found in a specific location rather than in all the possible states predicted by the wave function. But before the observation takes place, nothing meaningful can be said about the electron, either because it exists in a superposition of all possible states or because it has neither a velocity nor a position. Erwin Schrödinger, who thought the idea absurd (Bruce 2004: 59; Kaku 2005: 138), exposed the paradox through a celebrated thought experiment. A cat is sealed in a box together with an atom of uranium that has a 50–50 chance of decaying in a certain time span. Being a quantum phenomenon, the decay cannot be predicted. Now imagine that if the decay takes place, a mechanism will be triggered that kills the cat. Before you open the box, the atom will have both decayed and not decayed, and in the interpretation

5. The interpretation of Erwin Schrödinger's equation as representing probabilities is due to Max Born, not to Schrödinger himself, who reportedly hated it (Wick 1995: 31). Though the equation accurately predicts the behavior of electrons, its interpretation remains a controversial issue in theoretical physics.

6. As Colin Bruce (2004: 63) observes, however, "There is no general agreement on what the Copenhagen interpretation actually is"; it seems to have been a "myth invented retrospectively by Bohr's enemies." What passes as the Copenhagen interpretation is a collection of ideas discussed by Bohr and his colleagues and disciples, among them Werner Heisenberg and Max Born, but they never came to a complete agreement on the interpretation of quantum mechanics. According to Jan Faye (2002), "Today the Copenhagen interpretation is mostly regarded as synonymous with indeterminism, Bohr's correspondence principle, Born's statistical interpretation of the wave function, and Bohr's complementarity interpretation of certain atomic phenomena." The Copenhagen interpretation is also widely associated with the primacy given to the role of the observer in determining the outcomes of experiments involving subatomic particles. This makes it an antirealist position, opposed to Einstein's belief that the role of physics is to elucidate the nature of an "external world independent of the perceiving subject" (Eisberg and Resnik 1985: 80). According to Bohr, "It is wrong to think that the task of physics is to find how nature is. Physics concerns what we can say about nature" (quoted in Herbert 1985: 45).

that Schrödinger wanted to discredit, the cat will be dead and alive at the same time: "In order to describe the cat, physicists add the wave function of the live cat and the dead cat—that is, we put the cat in a nether world of being 50 percent dead and 50 percent alive simultaneously" (Kaku 2005: 158). It is the action of opening the door that sends the cat either to Hades or back to her favorite pillow.[7] But who is this mysterious observer who seals the fate of the feline? Could it really be the scientist? And does the scientist need a PhD? (as Colin Bruce [2004: 69] suggests tongue-in-cheek). "But why," asks Greene (2004: 207), "should fundamental physics be so closely tied to human awareness? If we were not here to observe the world, would wave functions never collapse? . . . Was the universe a vastly different place before human consciousness evolved on planet earth?"

For the proponents of multiple universes, the logical contradiction as well as the problematic decisive role of the observer are unacceptable. As Tegmark (2003: 46) writes:

> Many legitimate wave functions correspond to counterintuitive situations, such as a cat being dead and alive at the same time, in a so-called superposition. In the 1920s physicists explained away the weirdness by postulating that the wave function "collapsed" into some definite classical outcome whenever someone made an observation. This add-on had the virtue of explaining observations, but it turned an elegant theory into a kludgy, non-unitary one. . . . Over the years many physicists have abandoned this view in favor of one developed in 1957 by Princeton graduate student Hugh Everett III. He showed that the collapse postulate is unnecessary. Unadulterated quantum theory does not, in fact, pose any contradiction.

What Everett suggested is that random quantum processes cause the universe to split into multiple copies, one for every possible outcome. The cat, consequently, is dead in one parallel universe, alive in another, and is watched in each universe by different copies of the observer or by none at all. In this interpretation, the multiple possibilities described by the wave function are more than possibilities—they are all actual phenomena taking

7. This interpretation is often referred to as the Copenhagen interpretation (cf. Woolley 1992: 220–21). But Bohr actually pointed out that the cat, in contrast to the atom, is not a quantum object and would consequently have been either dead or alive at any moment in the experiment, even when the state of the atom is unknowable. It would take a quantum cat—whatever that is—to be 50 percent dead and 50 percent alive before the box is opened. (I owe this information to the anonymous reviewer of my text.) While the exact content of the Copenhagen interpretation cannot on the whole be pinned down, it can be nevertheless firmly associated with the idea that the act of observation causes the wave function to collapse; in other words, observers may not determine the fate of the cat, but they do determine the state of the particles of the atom.

place in different worlds. Hence Åberg's pronouncement must be reversed into: "quantum mechanics is a theory of actualities, not of potentialities . . . a theory of possible worlds which are all actual."[8]

What happens to worlds once they are generated by the wave function? A notion known to physicists as decoherence suggests that after they split apart, they follow separate courses and never merge again. "In the many-worlds interpretation," writes Kaku (2005: 386), "the wave function of the dead cat and the live cat have decohered from each other and hence no longer interact, thus solving the problem of how a cat can be simultaneously dead and alive. . . . Decoherence simply explains the cat paradox without additional assumptions, such as the collapse of the wave function." Yet not all proponents of the many-worlds interpretation equate the splitting of worlds with a total lack of interaction. Decoherence can be weak or strong: "Weak decoherence creates slightly different world lines that continue to interact. . . . Strong decoherence creates steadily divergent lines" (Bruce 2004: 182). At least one prominent physicist, Deutsch (1997) of Oxford University, invokes the idea of interference between worlds to resolve a classical dilemma of theoretical physics: is light a wave, or is it made of particles?

Following Einstein, physicists generally agree that light consists of elementary particles known as photons, but in some circumstances these particles display a behavior disturbingly similar to a wave pattern. A celebrated experiment involves a light beam going through a barrier in which two slits have been cut and hitting a photographic plate on the other side. If light is made of particles, each particle should go through one or the other of the two slits, and the pattern recorded on the photographic plate when the barrier contains two slits should overlay the pattern obtained when the light goes through only one slit. It will consequently look like figure 1. On the other hand, if light is a wave, this wave will be divided between the two slits, and the portions of the wave coming out of each slit will interfere with each other. This will result in the pattern shown in figure 2: the multiple bars are created by the bumping of the waves coming out of each slit. As it turns out, the experiment produces the wave pattern of figure 2 rather than the particle pattern of figure 1. But what would happen if, instead of shining a light beam through the two slits, we turned the light down to the point where "individual photons are being fired one by one through the barrier" (Greene 1999: 101)? Then each individual photon should go through either one slit or the other, and after many photons have been fired and recorded on the photographic plate, we should get the pattern of figure 1. But instead,

8. If this sounds contradictory, let us recall that, in possible worlds (PW) theory, the actual world is a member of the set of all possible worlds.

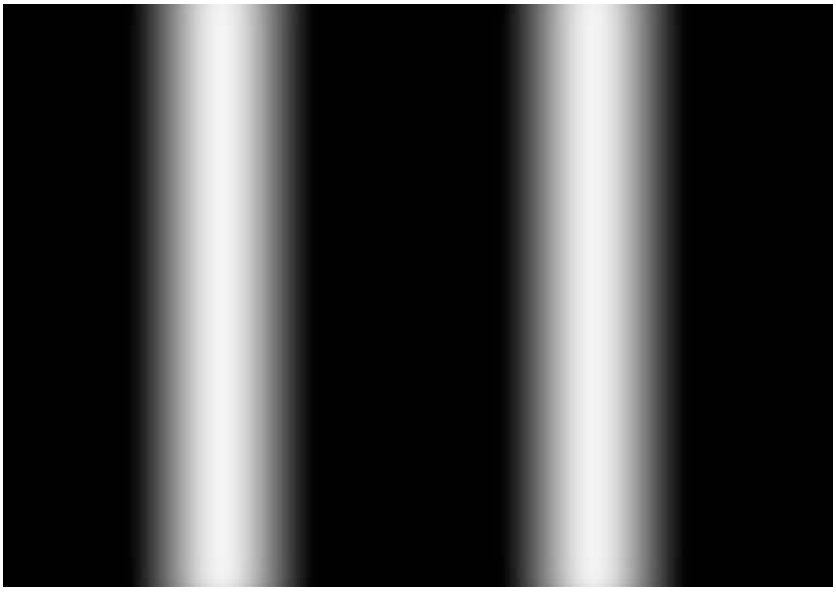

Figure 1

we still get the wave pattern of figure 2, as if each photon went through both slits simultaneously and interfered with itself. How can this be explained?

The standard approach is Niels Bohr's famous idea of *complementarity*: sometimes light behaves like particles, sometimes it behaves like a wave, and we must be able to switch perspective to deal with the totality of the phenomenon. But is complementarity an explanation or a mere description of observations, a way to "evade the implications of quantum theory for the nature of reality," as Deutsch (1997: 342) describes the Copenhagen interpretation? Taking a decidedly realist stance, by which physics is concerned with nature itself rather than, as Bohr conceived of it, with "what we can say about nature" (see note 6), Deutsch eliminates the duality inherent to the notion of complementarity by suggesting that the wave pattern created by photons as they go through the holes in the barrier is due to interference by photons from other universes. Deutsch's notion of interference marks an important difference between the multiple worlds of levels 1, 2, and 4 and those of level 3. On the former levels, multiple worlds seem to lead truly parallel, separate existences after their branching out from a common stem; but on level 3, they bump into each other, affecting the trajectories of their constituent particles. If it were not for this interference, we (or rather, Deutsch) would not be aware of their existence. Comparing a two-slit with a four-slit pattern, Deutsch (ibid.: 43–53) observes that some

Figure 2

points which are bright on the photographic plate when the light comes out of two slits become dark with a four-slit barrier. He explains this phenomenon by claiming that the trajectories of photons are deflected by what he calls "intangible photons," this is to say, by photons originating in parallel universes which we cannot see. Conversely, the tangible photons of our universe become intangible in other universes.[9]

Whether the parallel-worlds interpretation of quantum physics is invoked to prevent the collapse of the wave function or to explain the behavior of light, it implies that every quantum phenomenon, this is to say, every movement of subatomic particles, causes the universe to split—the particles taking a different route in each of the resulting parallel universes. Wittily captured by the title of Colin Bruce's book *Schrödinger's Rabbits: The Many-Worlds of Quantum*, this absolutely dizzying explosion explains why the idea

9. I do not see, however, how the idea of interference from parallel worlds explains another strange phenomenon: if a device is installed at the slits to tag photons as they go through, so that you can tell through which slit each photon passed, the pattern recorded on the screen on the other side of the slits is once again a particle pattern, as if the photons were aware of being observed. Even more curiously, when the mark is erased before the photons hit the screen, they produce once again a wave pattern. (Cf. Greene 2004: 191–94.) But this is perhaps not so surprising as one may think: as Bruce (2004: 28) observes, "Any kind of detector cannot avoid doing something to the particle passing it."

of parallel universes has encountered far stronger opposition for level 3 than for levels 1 and 2, where the birth of other worlds remains a special event rather than a routine phenomenon that takes place every split second. (Level 4 is far too speculative to provoke passionate reactions.) The idea of a constantly splitting universe violates the principle of Occam's razor, which prohibits the introduction of unnecessary entities into a theory, but Deutsch would reply that his proposal is the only one that *explains* anything.[10] Moreover, once we assume the existence of parallel universes, postulating an infinity of them will not further violate Occam's razor, because what the principle arguably seeks to limit is a qualitative, rather than quantitative, proliferation of theoretical entities. In other words, the entity that violates Occam's razor is the first additional world; all the others come for free.

If physicists agree on one issue, it is that elementary particles seem to obey different laws than do large-scale phenomena. The many-worlds interpretation of quantum phenomena is one of the many attempts to conquer what Greene (1999: 3) calls the Holy Grail of theoretical physics: devising a theory that reconciles quantum mechanics with Einstein's relativity, two theories which "*cannot be both right*" (italics original) in their current formulation. (Another pursuer of the Grail is superstring theory.) According to Bruce (2004: 183), the "Oxford interpretation" (i.e., Deutsch and his followers) "allows us to play our game with the gods against the backdrop of a universe in which events unfold objectively and locally, in which faster-than-light effects do not operate, and in which quantum probabilities arise naturally, without arbitrariness." In view of such enormous benefits, the cost of adding never-observed entities to physics appears negligible. The worst that can happen is that the Holy Grail will fail to turn up among the many worlds.

Multiple Realities in Narrative Theory

The literary and narratological counterpart of the notion of parallel universes in physics is known as possible worlds (PW) theory. (Readers familiar with the theory and with Ryan 1991 in particular can skip this section.) The main proponents of the PW approach to narrative are Umberto Eco (1984), Thomas Pavel (1986), Lubomír Doležel (1998), Ruth Ronen (1994),[11] and

10. Another proposal with explanatory power is David Bohm's 1952 idea that the trajectory of particles going through the slits is influenced by a "hidden variable"—a wave propagating through both slits (Bell 1989: 365; Deutsch 1997: 93; Bruce 2004: 69–71). According to Bohm, light is not particle *or* wave, but particle *and* wave. Bohm's postulation of the hidden variable also violates Occam's razor but not as flagrantly as the many-worlds hypothesis.

11. Ronen, however, is more a critic than a proponent of the approach: the main focus of her

myself.[12] Umberto Eco (1984: 246) describes the narrative text as a "machine for producing possible worlds," and it seems indeed that new worlds sprout in the narrative universe every time a character contemplates or makes a decision—just as in the many-worlds interpretation of quantum physics, parallel universes sprout in the multiverse every time a particle generates a wave function.

The narratological application of the notion of possible worlds is an adaptation of a model developed in modal logic by philosophers of the analytic school, such as Saul Kripke, Jaakko Hintikka, Nicholas Rescher, Alvin Plantinga, and especially David Lewis. Modal logic is a branch of formal semantics concerned with the truth conditions of the operators that express possibility and necessity. These operators form the so-called "alethic" system. Other modal systems have been built around operators expressing what is known as "propositional attitudes," such as beliefs, obligations, and desires. It is these variants that are the most useful to narrative semantics, because they can be used to describe and diversify the content of the minds of characters. Modal logic is also concerned with the truth conditions of counterfactual statements—for instance, what makes people think that a statement like "If Napoleon had not tried to invade Russia, he would have remained emperor until his death" contains more truth than "If Napoleon had ridden a black horse into Moscow, he would have remained emperor until his death"? As we shall see below, there is a close connection between the truth conditions of counterfactuals and those of interpretive statements concerning fictional worlds.

The foundation of PW theory is the idea that reality—now conceived as the sum of the imaginable rather than as the sum of what exists[13]—is a universe composed of a plurality of distinct worlds. (Here the contrast between "universe" and "world" is much more significant than in physics.)[14] This universe is structured like a solar system: at the center lies a world commonly known as "the actual world," and this center is surrounded by

book is how literary critics take metaphorical liberties with the "pure" concept of possible worlds proposed by philosophers.

12. The version of the application of PW theory to narrative presented here is the one I develop in my book *Possible Worlds, Artificial Intelligence, and Narrative Theory* (1991). I do not claim to be speaking for all the scholars mentioned above, though I have been inspired by most of them.

13. For adherents of modal realism, such as David Lewis (see below), there is no difference between these two sets: everything that can be imagined exists.

14. Bowing to common usage, I will occasionally use the term *fictional world* to refer to the entire semantic domain created by a fiction, regardless of whether this domain is a classical or a multiverse cosmology and ignoring my own claim that every narrative projects a universe composed of many worlds.

worlds that are possible but not actual. These worlds lie at a variable distance from the actual world and resemble it to various degrees: in the closer worlds, I have counterparts of myself who only differ from my actual self in the number of hairs on their heads, while in the more remote worlds, I win the Nobel Prize for Physics, I am embodied as a giant insect while retaining my basic identity (a thorny problem for philosophers), or I do not exist at all. For a world to be considered possible, it must be linked to the center by a so-called "accessibility relation." The boundary between possible and impossible worlds depends on the particular interpretation given to this notion of accessibility. The most common interpretation associates possibility with logical laws; every world that respects the principles of noncontradiction and the excluded middle is a possible world.[15] On the basis of this model, we can define a proposition as necessary if it is true in all the worlds linked to the actual world (including this actual world itself); as possible if it is true in only some of these worlds; as impossible (e.g., contradictory) if it is false in all of them; and as true, without being necessary, if it is verified in the actual world of the system but not in some other world.

The PW model is based on a fundamental difference between the actual world and the merely possible ones. But what is it that singles out one of the worlds as actual? What, in other words, is the nature of actuality? Here we have two possibilities. The most commonsensical is the absolutist view. It says that the actual world differs in ontological status from merely possible ones in that this world alone presents an autonomous existence, which could mean: exists physically. All other worlds are the product of a mental activity, such as dreaming, imagining, foretelling, promising, or storytelling. The other interpretation, proposed by Lewis (1973: 84–91), is known as modal realism. It says that all possible worlds are equally real and that all possibilities are realized in some world, independently of whether somebody thinks of them or not. But if all possible words are real, how does one pick one of these worlds as actual? For Lewis, actuality is an indexical notion whose reference varies with the speaker, like the reference of deictics like "I" and "you" and "here" and "now." "The actual world" means "the world where I am located," and all possible worlds are actual from the point

15. In chapter 2 of Ryan 1991, I propose other interpretations of accessibility designed for the study of fiction. For instance, two worlds can be considered accessible from each other if they follow the same laws of nature (nomological accessibility); this makes the worlds of fairy tales inaccessible from our actual world. Or two worlds may be linked when they contain the same individuals. This precludes relations between the actual world and the worlds of novels that contain imaginary characters. And finally, two worlds may be accessible from each other when the history of the second world can be entirely contemplated from the point in time occupied by the first world. This eliminates novels of anticipation but not historical novels.

of view of their inhabitants. According to this view, our world, which we regard as actual, is a nonactual possible world from the viewpoint of the members of those worlds that we regard as nonactual.

The indexical notion of actuality is very important for the phenomenology and semantics of fiction. We normally think of fictional worlds as imaginary and as nonexisting. We know that, in contrast to our world, they are produced by a human mind, that of the author. But this does not explain how we relate to them. If fictional worlds were nothing more than nonactual possible worlds located at the periphery of the system of reality, we could not explain how the contrast actual/nonactual repeats itself, recursively, within fictional worlds. When we read a text of narrative fiction, we take some statements as establishing hard facts for the story world and others as describing what is merely possible or what exists only in the minds of the characters. In other words, a fiction is not just a nonactual possible world; it is a complete modal system centered around its own actual world. We relate very differently to a fictional world and to a world created through statements that stress its imaginary character, such as the conditional mode or an "if . . . then" construction. The trademark of fiction, as opposed to other nonfactuals, is the grammatical factuality of a very large proportion of the statements that make it up: fiction is overwhelmingly told in the indicative mode. PW theory explains this pseudo-factuality by postulating a gesture of imaginative recentering of the reader, spectator, or player into fictional worlds or, more precisely, into the actual world of the fictional system of reality. The experience of fiction has been compared by Kendall Walton (1990) to a game of make-believe, but what exactly is it that we pretend to believe when we immerse ourselves in a work of fiction? PW theory, as I present it here, is by no means the only one to associate the reader's experience of fictional worlds with the "as if" stance of make-believe or to try to explain the phenomenon of aesthetic illusion (beside Walton, see Gerrig 1993; Schaeffer 1999; and Wolf 2004), but by relying on the contrast actual/possible (or virtual), as well as on the indexical theory of actuality, it is able to propose a precise formulation of the rules of the fictional game. These rules can be spelled out as "pretending to believe that fiction describes a world which is both real and actual." Pretending that this world is real means pretending that it exists independently of the text, while pretending that it is actual means transporting oneself in imagination into this world and adopting the point of view of one of its members.

PW theory not only explains the imaginative experience that we undergo when we immerse ourselves in a fictional world, it also provides a foundation for a semantics of fiction. Adapting his analysis of counterfactual state-

ments to the case of fiction, Lewis (1978: 42) provides criteria for regarding a statement like "Emma Bovary was a devoted mother" as false with respect to the world of Flaubert's novel: "A sentence of the form 'in the fiction f, p' is non vacuously true iff [if and only if] some world where f is told as known fact and p is true differs less from our actual world, on balance, than does any world where f is told as known fact and p is not true." Thus, it is false to claim that Emma Bovary was a devoted mother, because a society where her attitude toward her daughter is regarded as devotion would be further removed in its values from our cultural pocket of the actual world than a society in which she is considered a neglecting mother.

The importance of PW theory is not limited to providing a logical and phenomenological account of fictionality. I believe that its most significant—and still largely unrecognized—contribution to narrative theory is to offer a cognitive model of narrativity that transcends the boundary between fiction and nonfiction. In the past few years, many scholars have moved away from regarding narrative as a type of literary discourse to viewing it as a way to organize human experience, more particularly the type of experience that has to do with agency, problem solving, and interpersonal relations. Stories are mental constructs that we form as a response to certain texts, artworks, discourse acts and, more generally, as a response to life itself, and narratives are the semiotic realization of stories: their inscription as texts, images, and sounds. The most fundamental mental operations that we perform to extract a story out of a text are the same ones that we execute to interpret the behavior of our fellow humans and to make decisions in our own lives. Literary narrative may require additional operations, but before we can perform them, we must process textual data according to certain fundamental patterns. It is the task of cognitive narratology to outline the basic mental templates into which we organize information in order to interpret it as a story. My claim, then, is that PW theory proposes such a template. What does it look like?

As narratology takes a turn toward the cognitive, the traditional conception of stories as "sequences of events" should be expanded into a model that involves not only the actual but also the virtual. The French structuralists Tzvetan Todorov (1969) and Claude Bremond (1973) were the first to point out that underlying the physical events presented as facts in the narrative universe is a complex network of events and states that never take place, such as possibilities contemplated by the characters and suppressed plotlines contemplated by the reader. For instance, to understand an (actual) action of a character, we must take into consideration virtual mental constructs, such as the goal and the plan of the character. These goals and plans

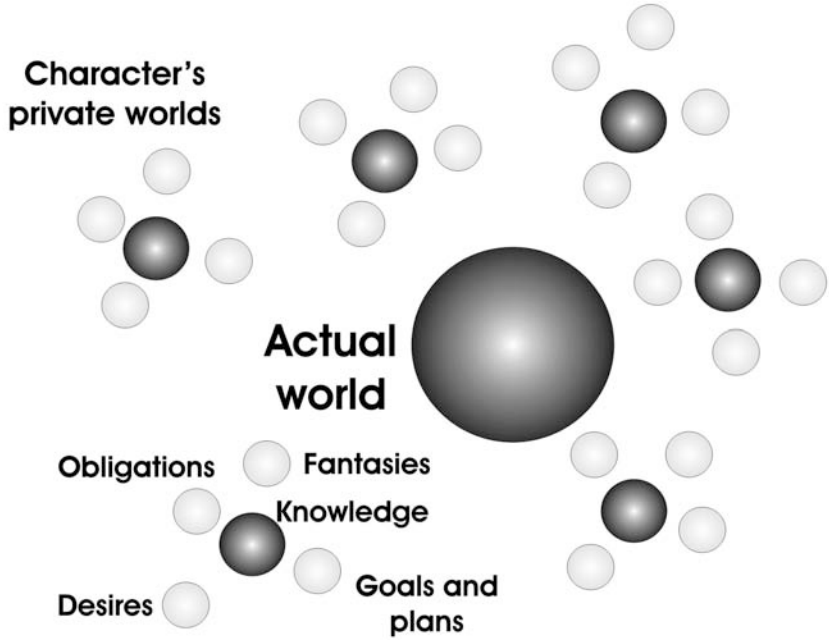

Figure 3

must in turn be linked to emotional states that attribute certain values to certain situations. When the action is performed, we must also compare its actual outcome to what the character hoped to achieve.

Through its fundamental opposition of one world to all others, PW theory provides a map of narrative universes that connects the factual to the nonfactual and the physical to the mental. I have suggested above that modal logic has extensions that deal with propositional attitudes. For instance, there is a deontic system that determines what is obligatory, allowed, and prohibited, an axiological system that deals with what is considered good, indifferent, and bad, and an epistemic system that distinguishes firm knowledge from mere beliefs and ignorance. To integrate these systems within narrative semantics, all we need to do is apply the label of "world" to the set of propositions in the mental life of a character that fall under the same predicate of propositional attitude. These various worlds form a semantic universe which looks like figure 3. The actual world of the system is constituted by the facts legitimately asserted by the narrator. In nonfiction, the reader is entitled to question the accuracy of these facts, because the textual actual world is itself processed as the image of an "actual actual world" that exists independently of the text, but in fiction these dec-

larations must be unconditionally accepted, unless they are attributed to an unreliable narrator, because of the performative force of fictional discourse. By virtue of this performative force, the fictional text creates its own world and its own facts, even though it pretends—and invites the reader to pretend—that it is describing an extratextual reality.

Surrounding this ontological center are the little solar systems formed by the private universes of the characters. Each of these subsystems is centered around its own epistemic world, which holds the character's representation of the entire system: this is to say, of both the actual world and the private worlds of the other characters (which themselves contain images of the private worlds of the character under consideration in a mirroring process that would lead to endless recursion if it were not for the limitations of the human mind). From the reader's point of view, the epistemic world of characters contains a potentially inaccurate image of the actual world of the narrative universe, but from the character's point of view, this image is the actual world itself. The private universes of characters also include model worlds, such as desires and obligations, which capture how the character would like the actual world to be; active goals and plans, which capture projected courses of actions leading to the fulfillment of the model worlds; and fantasy worlds, such as dreams, hallucinations, and stories within stories, which embed, recursively, new modal systems. Within a dream, there is indeed an actual world, as well as a cast of characters whose mental lives consist of a number of private worlds.

But a story is not a static snapshot of a certain state of a modal system. During the course of the story, the distance between the various worlds of the system undergoes constant fluctuations. Whenever a proposition in a model world becomes unsatisfied in the actual world, the narrative universe falls into a state of conflict. These conflicts are represented in figure 4 by the overlap between the model world in question and the character's representation of the actual world: a satisfied model world (O for obligations, W for wishes) is fully enclosed in a character's epistemic world (labeled K for knowledge); a conflicting one lies partially or totally outside the K world. The motor that operates the narrative machine is the attempt by characters to eliminate conflict by reducing the distances between their model worlds and the actual world. Conflict can also exist between the model worlds of different characters; for instance, the hero and the villain are antagonists, because they have incompatible W-worlds and work toward incompatible states. Or characters may experience conflict between their W-world and O-world and have to choose which one to try to satisfy. PW theory thus models narrative dynamics as the movement of individual worlds within the global narrative universe. This movement does not end when all conflicts

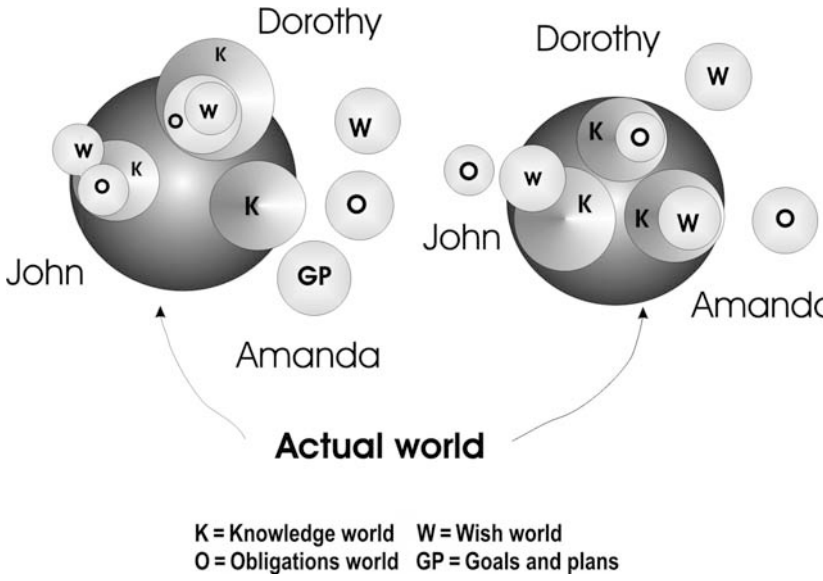

Figure 4

are resolved, for conflict is a permanent state of any universe, but when all the remaining conflicts cease to be productive because their experiencer is no longer willing or able to take steps toward their resolution.

Consider figure 4: the left part represents the beginning of an imaginary story, a love triangle between three characters, and the right part represents the end. Let us imagine that John and Dorothy are a married couple and that Amanda has her eyes on John. Amanda's desires are consequently unfulfilled, and she has an active goal and plan to satisfy them. John's marriage is a good one, not a great one, and he is reasonably satisfied, though he would like a more exciting sex life; when the story begins, he has thus far been faithful to Dorothy, and his O-world is satisfied. Dorothy's K-world conflicts with reality, because she knows nothing about Amanda's plans for John, but she is faithful and satisfied with her marriage. At the end of the story, Amanda has fulfilled her desires, and she does not care about moral obligations. John has been unfaithful, but his sex life has improved, though he wishes he did not have to be involved with two women. And Dorothy has learned about the liaison, which alienates her W-world from reality, but she has maintained her moral standards. Since this is the end of the story, nobody has an active goal and plan.

My claim, then, is that figures 3 and 4 capture an essential layer of the global model of coherence toward which we work when we try to read a

text as a story. Trying to establish what holds as fact in the actual domain of the narrative universe, distinguishing the factual and physical from the possible and virtual located in the mental representations of characters, but also building an image of these mental representations as a way to grasp the human significance of physical events and actions are some of the most fundamental of the cognitive operations that lead to the construction of narrative meaning. We are not always—in fact, we are rarely able—to fill out all of the component worlds of the narrative universe; but the better we fill them out, the better we will grasp the logic of the story, and the better we will remember the plot.

Parallel Universes and Possible Worlds: Comparing the Two Models

Beyond their obvious similarity, the many-worlds interpretation of physics and the PW model of narratology differ from each other in some fundamental ways. To capture their differences, let us go back to the philosophy of Lewis, which served as an inspiration for both. Lewis, as we have seen, is famous for two correlated views: modal realism and the indexical theory of actuality.

The narratological application of PW theory supports the indexical theory of actuality, because it explains how fictional universes can be centered around their own actual worlds, even though, from the point of view of our world, they are nonactual creations of the imagination. To the reader immersed in a fiction, the center of the fictional universe functions temporarily as the actual world, and this reader relates to the characters as if they were flesh and blood human beings. Physics, on the other hand, has little use for the contrast between the actual and the nonactual and consequently for any definition of actuality—whether indexical or absolute. If parallel universes exist, they are collections of material objects, such as stars, planets, and galaxies, and they are not structured by the modal opposition between a single actual component and many nonactual possible ones. Within parallel universes, all objects exist in the same ontological mode—the mode of actuality. Even when physics deals with probabilities—that is, when it calculates the wave function of a particle—the many-worlds interpretation denies any contrast between the actual and the nonactual, since it regards all probabilities as simultaneously realized in some world. "In the Many-worlds Approach," writes Greene (2004: 206), "no potential outcome remains merely a potential. . . . Every potential outcome comes out in one of the parallel universes."

These positions are reversed on the issue of modal realism. For those who conceive physics as an attempt to describe an external reality inde-

pendent of the perceiving subject, adherence to modal realism is mandatory. Both Deutsch and Tegmark have sought interdisciplinary support in Lewis's postulation of the objective existence of multiple worlds. According to Deutsch (1997: 340): "The fruitfulness of the multiverse theory in contributing to the solution of long-standing philosophical problems is so great that it would be worth adopting even if there were no physical evidence for it at all. Indeed, the philosopher David Lewis, in his book *On the Plurality of Worlds*, has postulated the existence of a multiverse for philosophical reasons alone." As for Tegmark (2003: 50), he invokes Lewis in support of the idea that underlies the fourth level of parallel universes: all mathematical structures exist physically. Lewis (2004), conversely, justifies his belief in multiple realities by arguing that the notion of quantum collapse in physics is untenable. In order to create interference patterns, parallel universes must exist objectively. As Deutsch (1997: 49) explains, "'The possible' cannot interact with the real: non-existent entities cannot deflect real ones from their path." Moreover, the existence of these worlds must be subject to falsification or verification. Tegmark (2003: 51) takes great pains trying to convince his reader that the existence of parallel universes is not mere fantasizing but an experimentally testable theory, and Bruce (2004: 140–74) mentions several experiments that supposedly demonstrate the existence of many worlds. The narratological application of PW theory, by contrast, is largely indifferent to the question of modal realism. For narratologists, possible worlds can be treated as what is known in philosophy as a theoretical fiction (an imaginary entity postulated for its explanatory power),[16] and as long as they can help conceptualize the cognitive structure of stories and the dynamics of narrative action, it does not matter whether or not they exist objectively. They could even be called something other than "worlds," if the model retains the basic distinction between the actual and the nonactual and if it differentiates the nonactual according to distinct types of mental activity corresponding to propositional attitudes, such as believing, wishing, or planning.

Narrating the Multiverse

When we read a narrative, we are naturally inclined to regard its universe as centered around one, and only one, actual world, and it takes a deliberate effort on the part of the author to fight this tendency of the reader. But

16. As are, for some people, Freud's unconscious, Lyotard's libido, or even the numbers that mathematics deals with. (Those with a Platonist bend, like Tegmark or Kurt Gödel [Goldstein 2005] before him, will on the contrary claim that numbers exist objectively.)

this does not mean that the PW model is incompatible with multiple realities: faced with a multiverse narrative, it would simply claim that its actual domain is made of a number of different worlds and that, within each of these parts, the distinction actual/nonactual repeats itself. But how can a narrative suggest the idea of parallel universes existing objectively?

Jorge Luis Borges has provided a description of the ultimate multiverse narrative in his short story "The Garden of Forking Paths" (1999). This narrative, also called "The Garden of Forking Paths," is a fictional novel written by a character in the story, the Chinese sage Ts'ui Pen. To the narrator (a descendant of Ts'ui Pen), "the book is a contradictory jumble of irresolute drafts. I once examined it myself: in the third chapter the hero dies, yet in the fourth he is alive again" (124). The scholar Stephen Albert explains to the narrator the reason for the apparent contradictions:

> In all fictions, each time a man meets alternatives, he chooses one and eliminates the others; in the work of the virtually impossible-to-disentangle Ts'ui Pen, the character chooses—simultaneously—all of them. *He creates*, in this way, 'several futures,' several times, which themselves proliferate and fork. This is the explanation for the novel's contradictions. Fang, let us say, has a secret; a stranger knocks at his door; Fang decides to kill him. Naturally, there are various possible outcomes—Fang can kill the intruder, the intruder can kill Fang, they can both live, they can both be killed, and so on. In Ts'ui Pen's novel, all the outcomes in fact occur; each is the starting point for further bifurcations. Once in a while, the paths of the labyrinth converge: for example, you come to this house, but in one of the possible pasts you are my enemy, in another, my friend. (Ibid.: 125)

Relying on a metaphorical process fundamental to human cognition—representing time in spatial terms—Borges invokes the image of the forking paths to describe a fundamentally *temporal* phenomenon:

> Unlike Newton and Schopenhauer, [Ts'ui Pen] did not believe in a uniform and absolute time; he believed in an infinite series of times, a growing, dizzying web of divergent, convergent and parallel times. That fabric of times that approach one another, fork, are snipped off, or are simply unknown for centuries, contain *all* possibilities. In most of those times, we do not exist; in some you exist but I do not; in others, I do and you do not; in still others, we both do. In this one, which the favored hand of chance has dealt me, you have come to my home; in another, when you come through my garden you find me dead; in another I say these same words, but I am an error, a ghost. (127)

The problem with Ts'ui Pen's novel is that it cannot be written. This is why Borges embeds its description within a perfectly linear short story that projects a classical ontology. It cannot be written, because a narrative must limit itself to a subset of all possibilities and because its branches must be

presented sequentially rather than simultaneously. Another obstacle to the actualization of Ts'ui Pen's novel is the fact that the merging of paths leads to contradictions. It is only in space that the paths of two visitors arriving at the same house can come together.[17] But in Borges's text, the forking paths are a metaphor for time, and timelines cannot merge, because this would mean that the propositions "x is y's friend" and "x is y's enemy" would both be true in the biography of x, in a violation of the law of noncontradiction.[18] The merging of distinct paths is also problematic from the point of view of narrative motivation, because x and y's personal relation is determined in the past, and the past casts a shadow on the future. The world where x and y are friends gives access to a different set of states, and consequently opens different narrative possibilities, than the world in which they are enemies. A story-generating system that relied on a network with convergent paths would consequently produce inconsistent stories: for instance x warmly greeting y even though they are enemies. PW theory would deal with this situation by saying that x does not arrive at the same house in the same world through different but converging timelines but, rather, that x reaches different houses in different worlds that occupy corresponding spatial coordinates within their respective worlds. For a Borgesian "Garden of Forking Paths" to maintain logical coherence along each path, it should consequently be modeled on a decision tree whose branches never merge rather than on a network diagram allowing circles and loops.

But if the branches are kept neatly separate, the worlds they represent will "decohere," to borrow the physics term, and Ts'ui Pen's novel will be

17. When the merging of paths is interpreted spatially, it is one of the most productive principles of plot design, as Hilary Dannenberg has shown in *Converging and Diverging Lives: Plotting Coincidence and Counterfactuality in Narrative Fiction* (forthcoming). Spatial convergence of destiny lines due to coincidence underlies, for instance, the widely found plot pattern of long-lost relatives being reunited through extraordinary events. Dannenberg's other fundamental principle of narrative design, counterfactuality, creates divergent plotlines. This concept applies to what I call here multiverse narratives, but in Dannenberg's interpretation it also covers narrative features compatible with a one-world cosmology: for instance, the counterfactual reasoning of characters, their construction of possible future scenarios, and narratives of alternate history.

18. Philosophers concerned with time logic, such as A. N. Prior (2003: 57), consider the possibility of a splitting of timelines but not of their merging, because "the future has openness to alternatives which the past has not." According to Lewis (2004: 12), some philosophers even object to the idea of splitting, "for when one becomes two, it seems that one single thing is identical to two different things." Lewis's (ibid.) solution to this problem is that "there are two all along, though before the branching the two were temporarily identical in the sense that they shared an initial temporal segment." Here "sharing a temporal segment" means being part of different timelines that follow parallel courses rather than being part of the same timeline. As Lewis (1986a: 70) explains elsewhere, "There is an initial segment of one world, and there is an initial segment of the other, which are perfect duplicates."

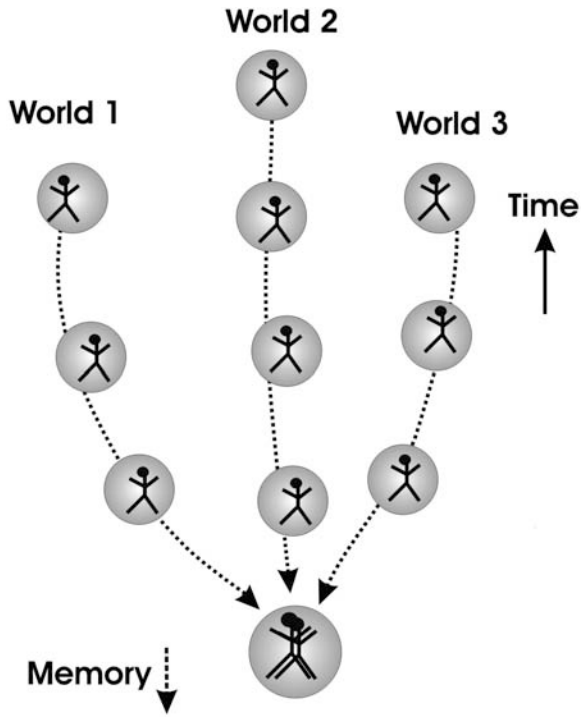

Figure 5

a collection of separate stories rather than a unified narrative multiverse. Just as it takes an entanglement of destiny lines to turn the lives of distinct individuals into a plot, it takes interference between its constituent worlds to turn a fiction with a multiverse cosmology into a cohesive narrative. This may be why Borges envisions a merging of paths, despite the logical contradiction inherent to the phenomenon.

Alan Lightman's *Einstein's Dreams* (1993) offers an example of a multiverse fiction without world entanglement (figure 5). One of the chapters represents three worlds that branch from a common stem. Each of these worlds contains counterparts of the same individuals: a man living in Berne and a woman he once met in Fribourg. In the first world, the man "decides not to see her again. She is manipulative and judgmental, and she would make his life miserable. Then, in three years, he meets another woman in a clothing shop in Neuchâtel. . . . After a year she comes to live with him in Berne" (19–20). "In the second world, the man . . . decides he must see the Fribourg woman again. . . . They make love, loudly and with passion. She persuades him to move to Fribourg. He leaves his job in Berne and begins to work

at the Fribourg Post Bureau" (20). "In the third world, he also decides that he must see her again. . . . After an hour, she says that she must leave to help a friend, she says goodbye to him, they shake hands. . . . He travels the thirty kilometers back to Berne" (21). We are told that all three chains happen simultaneously in the multiple dimensions of time, but there is no communication from branch to branch, and what happens in one does not affect the others. Because of this lack of interference, the three chains create different stories rather than a unified plot encompassing parallel realities. But Lightman's book is designed as a series of autonomous "dreams" illustrating the diverse conceptions of time that the imagination can extrapolate from Einstein's theory of relativity, and this fragmentation, which takes place within one of the dreams, is fully compatible with the thematic unity of the book as a whole.

For a text to impose a multiverse cosmology, it must be based on a decision tree or on a diagram with parallel branches (for those texts that do not assign a common origin and a genealogy to their component worlds), and all the branches must possess equal ontological status. But this is not sufficient to create situations of narrative entanglement. In order to do so, the text must not only move up and down along the branches, it must also perform lateral jumps from branch to branch, and there should be a consciousness within the narrative multiverse that is aware of the jumping. In Lightman's text, narration follows one branch to its end then backtracks in time, takes another branch, follows it, backtracking once again to take the third branch, but the characters along the three branches do not know that they have counterparts, and the various stories do not influence each other. In a fully integrated multiverse narrative, by contrast, characters either travel physically from branch to branch or know with certainty that other branches exist objectively. This knowledge affects their behavior and consequently alters the history of their own universe.

Multiverse narrative overlaps with three types of story common in fantasy and science fiction, namely, the narrative of transworld exploration, the narrative of alternate history, and the time-travel narrative. But it cannot be reduced to any of them, because these story types exist in both a one-world and a many-worlds version.

In most narratives of transworld exploration, such as *Gulliver's Travels*, *Star Trek*, and *Star Wars*, all the worlds belong to the same space-time continuum, and the travels of characters are presented as nothing more than a journey through an extended space, even when this journey requires vehicles far beyond current technology. In *Gulliver's Travels*, the continuity of space-time is demonstrated by maps that locate the various worlds within real-world geography: for instance, Lilliput is near Sumatra, and Brobding-

nac is a peninsula on the California coast. But in a variant that I call the wormhole narrative, transworld—or rather cross-world[19]—travel is limited to narrow portals usually open only to those with special powers (supernatural abilities, birthright, being selected among all individuals by the masters of the other world, etc.), and passing through these portals amounts to being transported into an alternate reality. These narratives usually present what Pavel (1986: 57) calls a salient structure or dual ontology: two realms differing sharply as to what is possible in them, such as the sacred and the profane. In the first book of C. S. Lewis's *Chronicles of Narnia*, for instance, children go through a wardrobe in the house of an old professor and end up in the magical realm of Narnia, where they meet supernatural creatures, such as Aslan the Lion and his antagonist, the Witch. In the fairy tale *Jack and the Beanstalk*, Jack climbs what looks like an ordinary plant and discovers that the leaves support entire worlds. And in *Harry Potter*, the wall at platform 9¾ of the King's Cross railway station in London serves as a portal between the world of everyday life, where Harry is a poor orphan mistreated by his adoptive family, and the magic world of the Hogwarts school of witchcraft, where he learns to be a master wizard. Whether this type of narrative rests on a two-world ontology with back-and-forth movement or on a network of interconnected worlds (Dannenberg 1998), it presupposes a discontinuous space-time pierced with secret passageways, similar to the wormholes in the fabric of the cosmos that connect the universes of level 2 (cf. Greene 2004: 264–65; Kaku 2005: 401 and passim).

Alternate- (or counterfactual-) history fiction creates a world whose evolution, following a certain event, diverges from what we regard as actual history. The cause of the divergence may be either a key decision at a special moment by an important historical figure (Napoleon, Hitler, and FDR are favorites) or a small random event starting a causal chain that leads to enormous consequences, in what is known in chaos theory as the butterfly effect. Whether alternate-history fiction presents the fate of the world as determined by human decisions at certain strategic points or shows it to be the product of forces too numerous and too complex to be controlled, the purpose of such thought experiments is to invite reflection on the mechanisms of history, and the real world always serves as an implicit background. But this does not mean that alternate history necessarily proposes a multiple-worlds cosmology, as Philip Roth's recent novel *The Plot against America* (2004) demonstrates. This novel explores what would have happened if in 1940 Charles Lindbergh had been elected president instead

19. I use transworld travel for narratives with a classical cosmology and cross-world travel for mutliverse stories.

of Franklin Roosevelt. Lindbergh was suspected of Nazi sympathies, and the novel describes the humiliating measures taken by the new administration against the Jewish population. For the characters of *The Plot against America*, the United States of President Lindbergh belongs to the one and only actual world, and there is no suggestion within the text of the existence of another objectively existing reality. But this is not to say that counterfactual history is incompatible with the multiverse cosmology: as we will see below, John Wyndham's "Random Quest" presents two versions of history as objectively implemented in different worlds. Drawing multiple lines of alternate history is indeed a favorite device of multiverse narrative.

Time-travel narratives present a two-way movement along one of the branches of the tree of historical possibilities. But this movement does not imply the existence of multiple parallel universes. In H. G. Wells's *The Time Machine* (1898), for instance, the hero travels from Victorian England to a distant future and then returns to the unchanged world of his spatiotemporal point of departure. Wells's chrononaut remains a relatively uninvolved observer of social structures, and after returning to the present he does not use the knowledge acquired during his trip to prevent the gruesome exploitation of the Eloi by the Morlocks observed in the future. But the time-travel story is a genre notoriously riddled with paradoxes (Nahin 1999), and the most important of these paradoxes is rooted in the single-universe cosmology. In the so-called "grandfather paradox," you enter a time machine, travel back in time, and kill your grandfather. This means that you will never be born and will never enter the time machine. Then your grandfather will not be killed and you will be born after all, and so on ad infinitum. As David Lewis (1986b) and David Deutsch and Michael Lockwood (1994) have argued, this vicious circle can only be avoided if one assumes that the actions of the chrononaut create a splitting of worlds, by which the grandfather is killed in one branch and lives in the other. By causing the death of his grandfather, the time traveler puts himself on a timeline in which he will never exist, and he will have to perform a lateral jump to another branch, as well as a jump in time, in order to return to his native reality. If this sounds almost as paradoxical as the vicious circle, think of the chrononaut as some kind of alien visiting a foreign world for a limited period of time.

The combination of time-travel and many-worlds cosmology is illustrated by the recent film *The Butterfly Effect* (2004). Evan, the hero, is a young man who experienced some traumatic events as a child: witnessing the suicide of his father, a patient in a mental institution; being forced by a neighbor to act in a pornographic movie; watching a friend torture and kill a dog; and participating in a deadly prank with other children. During each of these events, Evan blacks out and represses the memories. But many years

later, as a college student, he discovers childhood diaries that a therapist made him keep to avoid a total loss of memory and, upon reading them, is transported back to the scenes of the traumatic events. This gives him a chance to act differently and to change his life, but every time he travels back to the past and chooses a different course of action, unforeseen side effects lead to tragedies that affect other people, until he reaches a world where he dies at birth—sadly, the best of all possible worlds.[20] What makes *The Butterfly Effect* a genuine many-worlds narrative is the fact that, as he first returns to the past and then is carried forward by the flow of time, Evan never returns to the same present from which he came. His time travel spans ever-new branches.

Multiverse Narratives and Counterpart Relations

From a narratological and philosophical point of view, the most intriguing aspect of the many-worlds model is the idea that we exist in multiple copies—that we are linked by what Lewis (1986a) calls counterpart relations to "other" individuals inhabiting parallel worlds. In this section I propose to explore several narrative variations on the notion of counterparthood, focusing on the personal relations of characters to those individuals who are at the same time themselves and somebody else as well as on the plot possibilities that these variations create.

When the lateral moves on the tree of possibilities link widely different worlds, the question of counterpart relation does not arise at all. In classical wormhole narratives, such as *Harry Potter* or *The Chronicles of Narnia*, the characters exist in only one copy, and when they are in one world, they are absent from the other. This pattern is predominant in narratives that present their multiple worlds as having always existed side by side rather than as branching from a common stem.

In another multiverse scenario, individuals are represented in each world by a material body, and cross-world travelers enter their counterpart's body as if it were a hollow envelope, while the regular inhabitant of the body conveniently disappears for the time of the visit (figure 6, left). This creates a mind-body split, since the body of the cross-world travelers belong to the new world, while their knowledge, memory, and sense of identity are those of their old-world counterpart. In John Wyndham's (1965 [1961]) "Random Quest,"[21] a young physicist, Colin Trafford, is transported, after

20. I am describing here the director's version available on the DVD. I am told that the version shown in movie theaters had a different ending.

21. I am indebted to Hilary Dannenberg for mentioning to me the two Wyndham stories discussed here.

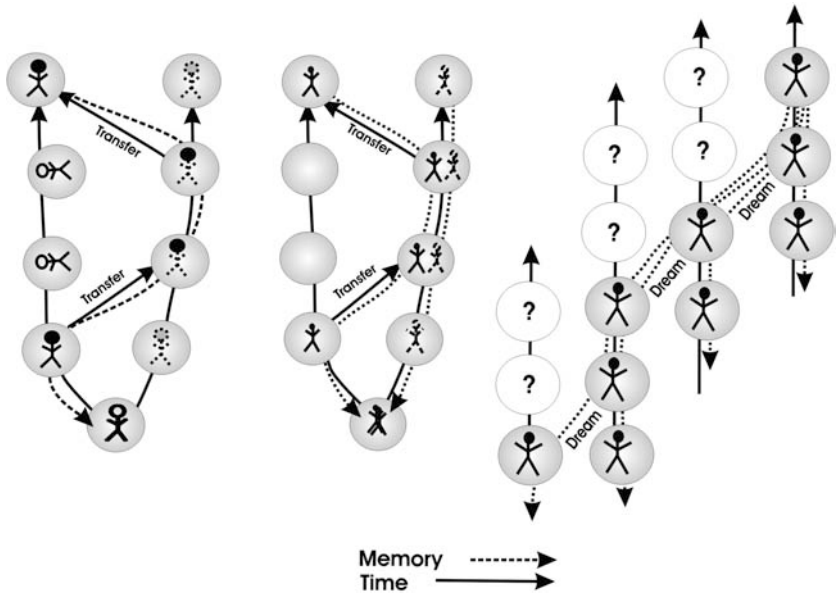

Figure 6

an explosion caused by an experiment in nuclear fission, into a version of 1954 England where World War II did not happen, Winston Churchill is not prime minister, and since the war did not support atomic research, theoretical physics is far less advanced. In this world, Trafford has become a very successful novelist. The "original" Trafford (i.e., the one from whose point of view the story is presented, henceforth Trafford 1) finds himself in a body partly familiar, partly foreign: while he recognizes his face in a mirror, this face wears a moustache, and his clothes are different from those he wore before the explosion. The involuntary character of the cross-world journey and the ensuing epistemological conflict create narrative situations particularly well-suited to arouse the reader's curiosity, a device regarded by Meir Sternberg (1992: 529) as one of the three fundamental principles of narrativity (or narrative dynamics), together with suspense and surprise. In episodes of powerful tellability, the story describes Trafford's puzzlement at the changes in his body, the gradual realization that this partly foreign, partly familiar body belongs to another world, the exploration of the new reality, and through a series of encounters with people who take him for Trafford 2, the discovery of the personality of his counterpart, whom Trafford 1 finds rather repulsive: as a writer, Trafford 2 caters to popular taste rather than maintaining artistic integrity, and as a husband, he cheats on his wife, Ottilie, née Harshom. When Trafford 1 visits the flat of Trafford 2 and

meets Ottilie, he realizes that she is the woman he was meant to love and marry, and he spends blissful weeks with her, while his body in world 1 lies unconscious in the hospital. (We do not know what happens to Trafford 2 while Trafford 1 occupies his body.) Trafford 1 finally awakens from his coma and engages in a desperate search for Ottilie's counterpart in world 1. He visits a certain Dr. Harshom to find out if he knows of any Ottilie Harshom; but the doctor discourages him: the only Ottilie Harshoms he knows of belong to a previous generation; and even if Ottilie existed in world 1, she would be a completely different person:

> Your counterpart varied from you, you say. Well, her counterpart if she existed would have had an entirely different upbringing in different circumstances from the other; the probability is that there would only be the most superficial resemblance. . . . Somewhere in the back of your mind you are giving house-room to the proposition that unlike causes can produce like results. Throw it out. (Wyndham 1965 [1961]: 165)

Against Dr. Harshom's rigid determinism, Trafford clings to a theory that leaves room for randomness. He speculates that the existence of multiple worlds is due to a natural splitting of atoms that takes place all the time and generates all possibilities. (By contrast, the cross-world travel that Trafford experiences is due to a partly human cause, namely, a scientific experiment in atomic fission.) I will call the type of reality model on which "Random Quest" is based a "quantum cosmology," because it involves an infinite number of worlds born at every moment, as opposed to those multiverse cosmologies in which the sprouting of worlds is due to isolated events, as in Tegmark's level 2. Here is Wyndham's (ibid.: 159–60) description of the quantum cosmology:

> Perhaps chance is continually causing two different outcomes so that in a dimension we cannot perceive there is an infinite number of planes, some so close to our own and so recently split off that they vary only in minor details, others vastly different. Planes on which some misadventure caused Alexander to be beaten by the Persians, Scipio to fall before Hannibal, Caesar to stay beyond the Rubicon; infinite, infinite planes of the random split and re-split by the random. Who can tell? But, now that we know the Universe for a random place, why not?

If every possibility is realized in some world, there is an infinitesimal chance that the Ottilie of world 1 has retained enough of her world 2 personality to be the love of Trafford's life. Through a fairy tale ending, this is indeed what happens: Trafford finds the counterpart of Ottilie in a woman named Belinda Gale, who lives in Canada but turns out to be the illegitimate daughter of Dr. Harshom's son, Malcolm. In world 1, Malcolm is killed before the birth of his daughter, and his lover marries a Mr. Gale, who

adopts and renames the baby. In world 2, Malcolm lives and marries his lover, and their daughter grows up as Ottilie Harshom. Differences in the circumstances of her upbringing have resulted in slightly different personalities, but Ottilie/Belinda has maintained a far more constant character than the two versions of Trafford: "Just one distant sight of her was enough. I couldn't have *mistaken* [Belinda] for Ottilie but she was so very, very nearly Ottilie that I would have known her among ten thousands" (ibid.: 169).

Rather than entering the corporeal shell of his counterpart, the visitor from a parallel world could confront a fully embodied version of his alter ego (figure 6, center). One of the few authors who have explored the narrative potential of this situation is once again Wyndham. In his short story "Opposite Number," Wyndham (1959 [1956]: 130) invents the notion of an "atom of time" to explain the incessant splitting of worlds and individuals:

> So, here we have Peter Ruddle. An instant later, that atom of time in which he exists is split, and so there are two Peter Ruddles, slightly diverging. Both these time-atoms split, and there are four Peter Ruddles. A third instant, and there are eight, then sixteen, then thirty-two. Very shortly there are thousands of Peter Ruddles. And because the diversion must actually occur many, many times in a second, there is an infinite number of Peter Ruddles, all originally similar, but all different by forces of circumstances, and all inhabiting different worlds—imperceptibly different, or widely different; that depends chiefly on the distance between the original point of fission.

"Opposite Number" confronts two fairly close versions of Peter Ruddle. Before their splitting apart, Peter Ruddle is a physicist working in an institute with old Whetstone, a "mad scientist" character who stubbornly believes in the quantum cosmology and in the possibility of cross-world travel. Peter is in love with Jean, the daughter of old Whetstone. In one world, he marries Jean and pursues Whetstone's research after the death of the old man and eventually invents a cross-world travel machine, which he uses to visit his counterpart. In the other world, Peter abandons Whetstone for mainstream research projects, and after Jean marries one Freddy Tallboy, he resigns himself to marrying another woman. I will call this version Peter 1, because the story is told from his point of view. Peter 1 provides a more interesting narrative perspective than Peter 2, because he is epistemologically deficient with respect to his counterpart, and the story can focus on his surprise as he is visited in world 1 by Peter 2. The latter's explanations serve the double purpose of satisfying the reader's curiosity and of solving Peter 1's puzzlement as he sees his old flame, Jean, visiting old Whetstone's lab with a man who looks strangely like himself.

The motivation for Peter 2's visit to Peter 1 is to improve the cross-world travel machine, which works so far only between close worlds, by pooling

their intelligences: "You know how one's mind tends to work in a groove—well, it occurred to me that if I could start one of my 'doubles' working on this thing, too, it might lead to a better understanding of it" (131). This idea of dividing a task between parallel minds situated in different worlds anticipates Deutsch's concept of a quantum computer, a machine based on atoms rather than silicon chips whose calculations, operating on the principle of distributed intelligence, would sum up information provided by multiple parallel universes (Deutsch 1997: 194–221; Kaku 2005: 173–74). As the two Peters compare their destinies, it becomes evident that Peter 2 has chosen the right path and has been rewarded by marrying his true love, while Peter 1 has betrayed both science and the woman who was meant for him. The sense that counterparts of Peter and Jean were predestined to love each other in all the worlds in which they exist is brought to a moving climax when the Jean of world 2 feels sorry for her counterpart and urges Peter 1 to renew relations with Jean 1. But this melancholic meditation on missed opportunities morphs into a comedy of errors when Peter 2 and Jean 2 are seen holding hands in public and the rumor spreads across world 1 that Peter Ruddle is cheating on his wife. The existential theme of the confrontation of selves has given way to the classical plot device of mistaken identity.

Yet another possible type of relation between counterparts is the merging of their consciousness within a single body (figure 6, right). Here individuals exist in only one copy in each world, but the memory of the traveling character reaches back into both worlds and creates a split identity. An example of this situation is found in Ursula K. Le Guin's fascinating science fiction novel *The Lathe of Heaven* (1971). The action of the novel takes place in Portland, Oregon, around 1998. It tells the story of a young man named George Orr who is affected by a strange mental condition: he dreams "effective dreams" that actually change the circumstances of his life. When George wakes up, he finds himself in a new reality that conforms to the dream. He first tries to suppress his effective dreaming by taking drugs, but when he exceeds the amount allowed by law, he is sent by the authorities to a psychoanalyst, Dr. Haber. Only by submitting to voluntary therapy can he avoid being prosecuted for drug abuse. The doctor's treatment consists of hooking George to a machine that places him in a sleep state and controlling his dreams through hypnosis. Haber soon discovers that he can change the world or, if one interprets the novel according to the plural cosmology, create a new world by scripting his patient's dreams. But every time he tries to solve one of the world's problems by suggesting a dream topic, the dream takes on a nightmarish quality, and the improvements it creates are the side effects of more catastrophic events. For instance, when Haber suggests that George dream a solution to the problem of overcrowding, the dream lands

them into a world whose population has been decimated by a pandemic; when he suggests that George dream the end of war between humans, the countries of the post-dream world no longer fight each other, because they are all threatened by an invasion of aliens who have already landed on the moon; and when Dr. Haber induces in George a dream in which the aliens have left the moon, they conquer the earth in the post-dream world. (Fortunately, they turn out to be quite willing to cohabit peacefully with humans.) When Haber thinks that he can now self-induce effective dreams, he cures George by having him dream the end of his condition, and he hooks himself to the sleep-inducing machine; but George pulls the plug and destroys Haber's ability to control the world. In the next world, Haber is a patient in a mental institution.

The Lathe of Heaven does not explicitly state that George and Haber are transported after each dream into a parallel world, and it is left to the reader either to construct a cosmology that supports the phenomena described in the novel or to leave these phenomena unexplained. When George says that reality is simply being "changed out from under us, replaced, renewed" (71), he suggests acceptance of the irrational, since this would involve a rewriting of the past, a phenomenon that most philosophers consider paradoxical.[22] Haber, on the other hand, calls the new realities "another continuum" (115), an interpretation strongly suggestive of a transfer to a parallel world with a different past. In a many-worlds cosmology, the dreams fuse George with the George of an already existing timeline rather than performing a logic-defying rewriting of his personal history. The many-worlds cosmology explains why, after each transition, George's memory reflects both the world after the dream and the world before the dream: "Although his memory assured him he had held this position for five years now [in the new world], he disbelieved his memory; the job had no reality to him. It was not work he had to do. It was not his job" (146). It is this split memory that motivates George to try to put an end to his effective dreaming; for if he only remembered the new world, he would not know that he came from another reality, and he would not be aware of his responsibility for the present state of affairs.

Every dream, every transfer to a new world adds a new thread to George's

22. On the unchangeability of the past, see Nahin 1999: 259–69. Among the philosophers who argue that changing the past is a logical impossibility, even to God, are Thomas Aquinas, G. E. Anscombe, and David Lewis. As the college philosophy textbook author John Hospers puts it (somewhat redundantly): "The past is what happened, and you can't make what has happened not have happened. Not all the king's horses or all the king's men could make what *has* happened *not* have happened, for this is a logical impossibility" (quoted in Nahin 1999: 259; italics in the original).

memory until he becomes unable to keep these threads apart: "He had no idea what, or how much [Heather] recalled, nor how to fit it within his multiple memories" (173). In the last world, George is finally freed from the terrible responsibility of effective dreaming, but the accumulation of memories from previous lives leaves almost no room in his mind for the formation of a new strand. With his consciousness turned into a battlefield of conflicting memories that tie him to other worlds, George has become totally alienated from his present environment: "The continuity which had always held between the worlds or timelines of Orr's dreaming had now been broken. Chaos had entered in. He had few and incoherent memories of this existence he was now in; almost all he knew came from other memories, other dreamtimes" (167–68). But the novel ends on a more positive note, as George takes Heather for a coffee break in order to sort out and put back together their scattered memories.

Philosophical Implications of the Quantum Cosmology

A short story by Larry Niven, "All the Myriad Ways" (1971), proposes a lively dramatization of the philosophical questions raised by the idea that we possess an infinity of counterparts in alternate worlds and that, through these counterparts, we take all the courses of action available to us. The story opens with a textbook exposition of the quantum cosmology:

> There were timelines branching and branching, a megauniverse of universes, millions more every minute. Billions? Trillions? Trimble didn't understand the theory, though God knows he'd tried. The universe split every time someone made a decision. Split, so that every decision ever made could go both ways. Every choice made by every man, woman and child on Earth was reversed in the universe next door. It was enough to confuse any citizen, let alone Detective-Lieutenant Gene Trimble, who had other problems. (1)

The problems that intrigue Trimble are senseless suicide and senseless crime, and they have both developed since the creation of a corporation named Crosstime that specializes in sending missions to parallel worlds and bringing back profitable inventions. Trimble observes a particularly high suicide rate among the pilots of Crosstime as well as a wave of gratuitous murders in the population at large. The action in the story is provided by Trimble's investigation of the suicide of Ambrose Harmon, the founder of Crosstime, who jumped from the twenty-ninth floor of an apartment after winning a large sum playing poker. But this investigation does not lead anywhere. Trimble discovers the explanation for the suicide not by inspecting the death scene but by reflecting on the logical, moral, and existential con-

sequences of the quantum cosmology. The suicide candidates know that if all possibilities must be realized, the suicide attempt will fail in some possible worlds and at least one of their counterparts will survive. Many others will die, but since death is the absolute end of consciousness, their tragedies will not matter to the survivor, who will be entirely focused on the life (or lives) that lie ahead. The story ends with Trimble testing the hypothesis on himself, with the expected multiple consequences:

> And he picked the gun off the newspapers, put it to his head and
> fired. The hammer fell on an empty chamber.
> fired. The gun jerked up and blasted a hole in the ceiling
> fired. The bullet tore a furrow in his scalp
> took off the top of his head. (11)

In a posthumously published essay, the topic of which eerily dovetails with that of Niven's story (though there is no evidence that he was familiar with it), David Lewis (2004) argues that in a quantum cosmology, death is impossible. Even if it appears in this world to be a biological necessity, we cannot rule out the possibility that a technological invention will prolong our lives forever in another world. In the many-worlds interpretation of quantum mechanics, there will always be a world in which Schrödinger's cat survives the experiment, even if it is repeated an infinite number of times. But to Lewis, this is not cause for rejoicing, because among "all the myriad ways" of surviving, some will involve a bullet tearing a furrow in our scalps—as Trimble will soon discover—and leaving us in permanently vegetative states. In an almost lyrical passage made deeply poignant to the reader by the thought that it could represent his last published words (he died unexpectedly shortly after presenting the essay at a conference), Lewis (ibid.: 21) writes:

> Everett's idea [that there is no quantum collapse] is elegant, but heaven forfend it should be true! Sad to say, a reason to wish it false is no reason to believe it false. So, how many lives has Schrödinger's cat?—If there are no collapses, life everlasting. But soon, life not at all worth living. That, and not the risk of sudden death, is the real reason to pity Schrödinger's kitty.

When I first presented this essay to a group that included both scientists and literary critics,[23] a physicist in the audience observed that none of the people who endorse the quantum cosmology has had enough faith in the theory to attempt suicide. But, rather than lacking faith, these people may have come to the same conclusion as Lewis: while survival is certain, so is the pros-

23. At the Conference on Science, Text, Audience, Reception (STAR) at the Kavli Institute of Theoretical Physics, University of California, Santa Barbara, March 2005.

pect of lasting forever in a state not worth living. Furthermore, quantum suicide would not convince the skeptics of the validity of the many-worlds hypothesis, because in most worlds it would leave only a corpse. And in the few worlds where it would not, the survival of the suicide candidate could be attributed to luck, not to necessity.[24]

The inevitable actualization of all possibilities opens another philosophical question, suggested in Niven's story by the increase in crime since the advent of cross-world travel. What is the point in trying to act morally if, for every path I choose, another me takes the opposite fork, if in some world Hitler behaves like Mother Teresa and Mother Teresa behaves like Hitler? Ethical behavior presupposes free will, but if all possibilities must be realized at least once, I am predetermined to act one way or another, and my free will is an illusion: "No. There was no luck anywhere. Every decision was made both ways. For every wise choice you bled your heart out over, you had made all the other choices too. And so it went, all through history" (Niven 1971: 8). While I may think that my decision forces one of my counterparts to act the opposite way, my counterpart is under the same impression, and it is impossible to determine whether one of us acts freely. Choice can only exist in a multiverse where each possibility can be realized a random number of times, including zero. Then by acting ethically, I increase both the total good of the multiverse and the quality of life in my own world, without dooming one of my counterparts to criminal action.

Conclusion

In 1985, at a Nobel symposium devoted to possible worlds (proceedings published in 1989), the eminent Irish physicist John S. Bell outlined six possible approaches to the apparent contradictions of quantum mechanics. Four of them concern specifically the interpretation of the two-slit experiment: (1) pragmaticism: be happy that the equations of quantum mechanics calculate probabilities accurately; do not ask any philosophical questions; (2) Bohr's complementarity: sometimes light behaves like a wave, sometimes like particles; (3) David Bohm's idea that the motion of particles passing through a slit is influenced by a hidden wave, so that instead of "particle *or* wave" we have "particles *and* wave"; and (4) the many-worlds hypothesis.

Bell, who endorses view 3, regards 1 and 3 as unromantic and 2 and 4 as romantic, because of the fascination they exercise on the imagination. By forbidding questions, pragmaticism kills all curiosity, while Bohm's theory

24. See also chapter 13 of Bruce 2004 ("The Terror of Many-Worlds") on the issue of quantum suicide and related problems.

has only recently started to attract interest among philosophers (Norris 2000) and novelists (Goldstein 2000). Complementarity, by contrast, is a favorite notion of postmodern theory, together with Einstein's relativity, Werner Heisenberg's uncertainty, and Kurt Gödel's incompleteness, even though these concepts are often interpreted in ways their original proponents would not approve of.[25] As for many worlds, its romanticism borders on sensationalism. The cover of *Scientific American* that advertised Tegmark's article carried a headline worthy of a tabloid: "Infinite Earths in Parallel Universes Really Exist." The imaginative appeal of the theory explains why in recent years the number of books about parallel universes in quantum mechanics has been out of proportion to the acceptance of the idea in the scientific community.

The detractors of many worlds will say that it is an idea worthy of science fiction, but it is precisely this importance for one of the most productive genres of twentieth-century literature that makes the theory fascinating to those interested in the workings of the narrative imagination. For literary scholars, who do not really care whether many-worlds cosmology is the best explanation of quantum mechanics, the interest of the theory is wide-ranging: it provides a powerful way to dramatize the "what if" mode of thinking that makes us marvel at the major consequences of apparently insignificant events for our destinies ("if I hadn't barely missed that plane, I would be dead"); it offers new points of view on such fundamental questions as identity, ethical responsibility, and free will; it encourages questions regarding the nature of space and time; it rejuvenates the old theme of the double; and it creates narrative situations which would not be possible in a system of reality limited to one world. For those interested in the motivation of plot from a technical perspective, the quantum cosmology raises the question of how narrative can support the idea of the incessant birth of an infinity of new worlds through a representation necessarily limited to a finite number of them. As David Bordwell (2002: 89) observes, the branched narratives of film never follow more than a handful of paths, and the same holds (probably with a higher upper limit) for literary texts.

The postulation of parallel universes is not only one of several ways to deal with apparent contradictions in the behavior of subatomic particles, it is also one of several possible modes of rationalization for texts that report contradictory versions of events. A genuine multiverse narrative must pre-

25. The postmodern recuperation concerns mainly the ideas of Einstein, who was a realist (cf. note 6), and of Gödel, who was a Platonist (Goldstein 2005). Bohr's and Heisenberg's positions are much more compatible with the postmodern endorsement of constructivism and antirealism.

vent the following strategies from yielding the most satisfactory interpretation (or, in the case of the third, from being the only valid one):

1. Mentalism

The multiple worlds described in the story do not exist objectively: they are the products of dreams, hallucinations, the imagination or they are the symptoms of mental conditions, such as schizophrenia or multiple personality disorder. An example of a narrative whose contradictions can be rationalized along these lines is Michael Joyce's hypertext *Afternoon* (1987). The story circles among many conflicting versions of an accident witnessed by the narrator: in one version, the accident is a mere fender bender; in another, it kills his ex-wife and son; in yet another, the narrator causes the accident. The most economical interpretation is to imagine that these contradictory versions are representations that pass through the mind of the narrator.

2. Virtualization

In a story with multiple branches, the world shown by the *current* branch is the only actual one; the others are just nonactualized possibilities. This situation is typical of interactive narratives, such as computer games or the children's stories of the Choose Your Own Adventure series. When the reader looks forward, the branches are all open possibilities, but after a choice has been made, the branches not chosen become counterfactual and usually disappear from the readers' minds until they start all over again. Similarly, in a computer game based on a branching story, the purpose of the player is to reach a winning state, and when this goal is achieved, the game story has been performed, the game has been beaten, and the branches passed over no longer matter.

3. Allegory and Metaphor

The purpose of the multiple versions is to illustrate an idea rather than to represent objectively happening courses of events: for instance, that the self cannot be reduced to a stable identity or that all versions of the world are equally valid, because reality is fundamentally unknowable. I personally interpret as allegorical the three branches of the German film *Run, Lola, Run* (1998), which shows three attempts by a young woman to save her boyfriend by bringing him, within twenty minutes, a sum of money he owes to the mob. In the first attempt, the boyfriend is killed; in the second, Lola is killed; and in the third, the money is brought in time, and they live happily ever after. Rather than rationalizing the apparent resurrection of the char-

acters though a many-worlds cosmology, I regard the plot as symbolic of Lola's willingness to do everything she can to save her boyfriend.

4. Meta-textualism

The characters did not lead parallel lives; rather, these lives are different drafts of a novel in progress, different developments that the author is contemplating. This situation is illustrated by the two endings of John Fowles's heavily self-referential novel *The French Lieutenant's Woman* (1969): in the first ending, the lovers, Sarah and Charles, are reunited; in the second, they part forever, Sarah having found fulfillment in a lesbian relationship. The second of the two branches is the one that tends to survive in the reader's mind as the ending in which "the author got it right."[26] The sense that the author is playing with possible scenarios is reinforced by metafictional comments that break the fictional illusion: for instance, "these characters I create never existed outside my own mind" (Fowles 1981 [1969]: 80). Most postmodern branching narratives fall into this category.

5. Magic

Reality is "changed from under us, replaced, renewed," as George Orr describes his experience in *The Lathe of Heaven* (1971: 71), so that what is true at one time becomes false at another through an unexplainable metamorphosis of the fictional world. The temporal distance between the two judgments of truth protects the fictional world from blatant contradiction, but the appeal to a magical change as "explanation" is a veiled admission of the irrational, or fantastic, nature of this world. For this interpretive strategy to remain compatible with the construction of a relatively coherent fictional world, the irrational must be limited to narrowly defined areas that pierce the texture of this world like the holes of a Swiss cheese. I personally attribute to a magical rewriting of the past the plot of the French novel *La moustache* (1986) by Emmanuel Carrère: It tells how the protagonist is gradually deprived of his personal history (and, consequently, his identity) as his memories are denied one by one by the witnesses to his life, though he still believes in their authenticity. Here recourse to a many-worlds cosmology would gratuitously add entities to the fictional universe without explaining anything.[27]

26. David Bordwell (2002) observes that, in branching films, the branch shown last tends to be regarded as the true version. This observation holds for both virtualism and meta-textualism.

27. Why do I endorse a many-worlds interpretation for *The Lathe of Heaven* but not for *La moustache*? Because George Orr has memories of many lives, which suggests lives in many worlds, but the hero of *La moustache* remembers only one life.

6. Do It Yourself

The contradictory passages in the text are offered to the readers as material for creating their own stories. A text that lends itself to such an interpretation is Robert Coover's short story "The Babysitter" (1969). The text consists of a collection of narrative fragments that seem to develop multiple, mutually incompatible stories out of a common situation: a young girl babysitting three children while the parents are at a party. The reader feels initially challenged to rearrange these snapshots into coherent timelines, but the motifs are so entangled that the task of neatly sorting them out and assigning them to distinct stories predetermined by the author turns out to be impossible. If the text is a game, it is less a puzzle to be solved than a construction kit that inspires free play with its elements.

If all these interpretations are eliminated, and if we want to avoid the acceptance of contradiction—an acceptance which, if applied to the entire semantic domain of the text, would prevent the construction of a fictional world[28]—then indeed we may have to rationalize the text through the idea of plural realities. But the multiverse interpretation must be either explicitly suggested through the kind of exposition of the quantum cosmology that we find in Wyndham and Niven or implicitly motivated by a thematic awareness of cosmological issues that invites the reader to reflect on the nature of space, time, identity, or memory. For most of us, the idea of parallel realities is not yet solidly established in our private encyclopedias, and the text must give strong cues for us to suspend momentarily our intuitive belief in a classical cosmology.

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28. The standard view in logic is that if a system of propositions contains even a single contradiction, anything can be proved (Goldstein 2005: 92) and it becomes impossible to construct a world out of these propositions. But I believe this view to be too strict in the case of fiction: if contradictions are limited to certain areas—to what I call above the holes in a Swiss cheese—then it remains possible to make stable inferences for the other areas and to construct a world. This is why we have many imaginable time-travel stories that contain causal loops: the future determining a past which determines the future.

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