Some Arcadian Questions: and Answers

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Abstract

The offstage death of Thomasina Coverly in Tom Stoppard's Arcadia can not be accepted as an accident and must be a suicide related to her Rabbit Equation and to the fate of Septimus the hermit. The equation leads Thomasina to Einstein's spacetime continuum and thus to his conclusion that time is an illusion and so is death:This is why she says "Oh, phooey to Death!" and "Oh, pooh to Hobbes!" By dying she escapes her delightful mother's plans to marry her off and forever relives her 17 years of life, including carnal embrace with Septimus.

Keywords: Stoppard, Arcadia, Thomasina

> "What matters it how far we go?" his scaly friend replied
> "There is another shore, you know, upon the other side.
> The further off from England the nearer is to France –"

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Once Tom Stoppard has his *Arcadia* alter ego Thomasina Coverly question Sir Isaac Newton's determinism, the audience should be excused for wondering with what theory she might replace it. First she says that if she understood all physics and algebra she "could write the formula for all future" (5).

But this is an empty tautology, true of any system of any number of moving parts or forces. The first advance occurs quickly when Lady Croom (13) inadvertently illustrates Einstein's special relativity. By Scene Three we are clear that the thrust of Scene One will define the play, and Thomasina will devote herself to a search for an alternative to Newton. She becomes fully engaged when Septimus tries to fob off on her God's "mastery of equations which lead into infinities where we cannot follow" (37) and seizing Occam's Razor, she slices into a physics that requires God's help, crying, "What a faint heart! We must work outward from the middle of the maze." Now she is on her way to 20th century cosmology, from the perspective of the audience, the only goal worth considering.

Despite all the *noise Arcadia* is very tightly organized. Into Scene One's 14 pages Stoppard has crammed, just for Thomasina and Septimus together, a verbal lesson on carnal embrace; Fermat's last theorem; Thomasina's growing feeling that Newton's cosmology is incomplete; the tortoise Plautus; her "Discovery" of how she might develop her own cosmology; two examples of Einstein's relativity; her repudiation of Poussin's notion "*Et in Arcadia ego*;" and the introduction of John the Baptist as the harbinger of the implications of her "Discovery."

Let us hope to confine ourselves to a manageable group of themes—Plautus; the Discovery; relativity; and Poussin—plus their development and why Stoppard has introduced them.

2 A Caution and Some Preliminary Answers to Our Questions

Stoppard has taken care to warn us against thinking he has settled the issues raised in *Arcadia*. In Scene Seven Hannah tells Valentine not to abandon his search for an algorithm of grouse populations: "You mustn't give up." And "It's all trivial—your grouse, my hermit, Bernard's Byron. Comparing what we're looking for misses the point. It's wanting to know that makes us matter. Otherwise we're going out the way we came in" (75). Does the playwright here advise us to consider the opposite view, expressed by Omar Khayyam, a mathematician and an astronomer himself, as well as a poet? He wrote:

Myself when young did eagerly frequent
Doctor and Saint, and heard great argument
About it and about: but evermore
Came out by the same door where in I went.

The Rubaiyat: Quatrain XXVI

The juxtaposition with Omar is not a mistake. *Arcadia* is perhaps the greatest play since 1616, but we may take the physics, Horatio, with a grain of salt. If the pre-curtain Big Bang in the gazebo, discovered in a telescope, has failed to alert the audience that Arcadia takes place in the spacetime continuum, Stoppard immediately asserts it again when Plautus the tortoise take exception to Septimus's proper Newtonian assertion that to stir jam out of rice pudding "time must needs run backward, and since it will not [….] [Stage Direction] (*He picks up the tortoise and moves it a few inches as though it had strayed, on top of some loose papers, and admonishes it.*) Sit!" (5). Sleepy Plautus has been vexed to nightmare by this heresy.

We may consider Septimus's bizarre construction, "time must needs run backwards," at our leisure as Stoppard carries Plautus through five back-and-forth shifts, by whole scenes, between early 19th century and the present day, always is in the same space, Thomasina's schoolroom. We may interpret these shifts as the mutability of time in our continuum. He also shows us various verbal images of chaos, recycling, characters talking past each other in confusion, the beautiful garden reduced to "an open cast mine for the mud", with a second-rate steam engine that the second-rate 'landskip' gardener thinks is such a wonder and which drags in the 2nd law of thermodynamics, but Stoppard's heart, and Thomasina's wager of her future, are committed to   exploring the continuum.

Between being almost 14 and the eve of her 17th birthday Thomasina fleshes out her cosmological "Discovery" and reaches Einstein's view that time is an illusion and thus spacetime simply exists, unchanging. Septimus's later career as a hermit shows that he did not concur. The shifts of time are not apparent to the characters, except perhaps for Gus/Augustus, though they share the experience of a Big Bang, or a Big Crunch, an apple, apple leaves, a decanter and wine, a glass, costumes, and music, not to mention a tortoise.

Thomasina and Stoppard take us on a tour of cosmology from Aristotle to Newton to Einstein to Hawking and beyond. Stephen Hawking is the physicist, unnamed, that Bernard isn't ready to push off a cliff (61). The tour leads her to believe that past, present and future must be only an illusion and thus she might, by dying young, according to Plautus dictum, avoid an arranged marriage her mother projects and a life time of regretting Lady Croom's order that "this business is over," and instead re-experience her youth, especially her happy years of education with with Septimus. Dying, that is, as soon as she has "practiced" carnal embrace with him. We will see how Stoppard uses modern ideas of our spacetime continuum, the "stubbornly persistent illusion" of time, a phrase from Albert Einstein. (In a letter of condolence to the sister of a friend, Einstein wrote: "For we convinced physicists, the distinction between past, present and future is only an illusion, however persistent." (Speziali 17-18).) To the illusion of time Stoppard adds two completed Big Bangs, both offstage, one before the play begins, one after it ends; relativity, starting in Scene One; iterated algorithms; the square root of -1; and entropy in order to require require the "death" of Thomasina Coverly, his outstanding creation thus far.

3 A Decent Respect for the Opinions of Others

None of the three volumes of Stoppard criticism which discuss *Arcadia* addresses all or several of these issues. This paper will try to answer most of them. In the course of setting out my literature review I will try comment only where others have touched on or perhaps jumped over one or more of our questions.

Jim Hunter's 2000 book *Tom Stoppard* is perhaps the richest of the critical writings on *Arcadia*. He does boldly note that the"Thomasina and Septimus, as her hermit, will die as forerunners of late-20th-century understanding" (Hunter 207), though he does not detail Septimus's contribution to this understanding--unreviewed "cabalistic proofs" burned up in a bonfire (28) do not count) to nor does Hunter relate to it, for example, Thomasina's work with minus roots in pushing on her latest iteration of her algorithm (78), her remarks "Oh, phooey to Death!" (13) and "Oh, pooh to Hobbes!" (84), or her untimely death.

When he addresses carnal embrace Hunter does not (Hunter 203) identify the perpendicular poke (2) with the Big Bang and gives no sign of looking for a Big Bang at the end. Neither do time or relativity much interest him..

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He draws no conclusion from Lady Croom's assertion that Mrs. Radcliffe wrote Walpole's *The Castle of Otranto* or that Byron has "got down a pigeon" (13, herself?) which her brother credits to Augustus and which her husband and Augustus tell us was a hare. Hunter mentions the leaves of Gus's time-traveling apple (Hunter 211) but ignores the slice of this apple which Septimus offers to Plautus (35 and the shreds of lettuce Valentine feeds his turtle, S.D. "([…] *not readily distinguishable from Plautus*) from between the bread slices of his sandwich (53). Hunter ignores the reprise of the sound of shotguns, from Scene One, in Scene Two, the "*distant pop-pop of a shotgun*" (17) which even Bernard notices at the beginning of Scene Two, and which draws Gus to the door, no doubt checking to see if the rake and hypocrite who claimed his hare has returned; Hunter mentions, (Hunter 163) and (Hunter 164) the recurring pistol shot, but makes no comment, perhaps not noticing that the movement between time slices.

A few more points on Hunter's otherwise excellent treatment: On his page 162 he correctly notes that the fire in the Cleopatra lesson foreshadows Thomasina's death by fire, but neglects to say that Cleopatra is literature's most famous suicide. While he mentions (Hunter, 165) "Thomasina's equations" (76), the iteration of her final algorithm, he seems find no significance in, and to dismiss, her essential statement--"No, if you set apart the minus roots they square back to sense" (78), Saying in in a parenthetical note. "(Don't worry: even to a mathematician this line borders on science fiction.)" (Hunter 180). As she has worked outward from the middle, starting with an time traveling apple leaf, Hunter's remark might have puzzled Bernard Riemman, master of the leaves of imaginary numbers (see below p. 11).

John Fleming in his 2008 book *Tom Stoppard's Arcadia* does not relate the perpendicular poke to the Big Bang. In his Plot Summary (Fleming 28-33) he gives short shrift to Plautus only mentioning (Fleming 32) that Thomasina draws the turtle with Septimus (87). He describes Lady Croom's assertion that "Mrs. Radcliffe " wrote Walpole's gothic novel, but makes nothing of it, also ignoring also the variety of reports about who shot what. His scene-by-scene plot summary skips the drawing of the hermit John the Baptist and the introduction of The Sidley Park Hermit.

He seems to be very interested the appearance of the 2nd law of thermodynamics in Arcadia as controlling the universe (Fleming 72) but fails to point out that we have no proof there is such a law or Thomasina's blithe dismissal of it "Then we will dance. Is this a waltz?" (94). Fleming, like Hunter, is also not much interested Einstein's time, inexplicably stating : "While the science level of Stoppard's play acknowledges that the laws of the universe indicate that time can only go forward "….]" (Fleming 37-38). This could not be at greater variance with our present cosmology or Stoppard's text, where all time exists at once, as shown by the alternating scenes, by the migrating Augustus/Gus, apple, tortoise, and the wine, decanter and glass in Scene Seven.

Katherine E. Kelly's first book about Stoppard, *Tom Stoppard and the Craft of Comedy* (1991) was too early to include *Arcadia*, but Kelly and William W. Demastes interviewed Stoppard in Austin, Texas, on Oct.15, 1993, six months after the play opened in London. The three said little that touched on our questions, however, when asked about romanticism and classicism combined with chaos theory, Stoppard seemed to dismiss the combination with chaos, saying some of his ideas were "yoked together by violence," an idea he attributed to Samuel Johnson and "I forced these things together. Otherwise the play's too thin [….] The play bifurcates two or three times and then goes into the last section, which is all mixed up. So it it's very chaos structure," (Kelly & Demastes).

When Kelly edited the excellent *The Cambridge Companion to Tom Stoppard* (2001) she included Paul Edwards's essay "Science in Hapgood and Acadia." Edwards discusses the motivation of the hermit Septimus, asserting, "Pain of her recoverable loss in the fire must be at the root of the hermit's desperate attempt to restore hope through 'good English algebra' " (65) (CCTS 182). Edward takes for granted that Septimus, spends the rest of his life, 22 years, worrying about heat loss. And him a rationalist? It is hard to see what the 2nd law, valid or not, has to do with her death. To support his view Edwards wants us think that the death of a girl Septimus just kissed for the first time the day before has driven him mad. If the early 19th Century English spent 22 years in mourning, and then died, for each accidental death, it is hard to see how the Battle of Waterloo could have been won or the Industrial Revolution accomplished. Edwards comes closer to the mark when he says "She cannot be brought back, certainly not by algebra," (CCTS 183). Edwards follows her "outward from the middle" but not far enough, thinking she is heading to heat death and thus missing the point of Thomasina's discovery and Septimus's scribbling."

Edwards make a few unimportant errors: he reports the wrong date for Fourier's heat essay, even, though Stoppard gives the right date, 1811, (CCTS 176); in his footnote 6 (CCTS 183) Mr Edwards, cites the wrong Nicholas Poussin painting, as Bernard accused Hannah of doing on her dust jacket. He cites Nicholas Poussin's Louvre version of "ET IN ARCADIA EGO," in which the occupant of the tomb is thought to be speaking, (Panofsky 316) "I, too, lived in Arcadia," rather than the *memento mori* Chatsworth version, the Poussin painting the Croom's know, "Even in Arcadia, there am I."

William W. Demastes, in his essay "Portrait of an Artist as a Proto-Chaotician" offers this suggestive, but ultimately cryptic, comment perhaps on how Thomasina and Septimus ended their lives: "Stretching limits of credibility and observing what ensues, challenging our powers of observation and data reconstruction, and offering multiple possible resolutions while at the same time rejecting subjectivity and randomness are all part of Stoppard's agenda."

Derek B. Alwes, in his essay "Oh, Phooey to Death: Boethian consolation in Tom Stoppard's *Arcadia* comes the closest to grasping Thomasina's new geometry: "Instead of a heavenly 'after life' among the angels Stoppard's play offers a vision of mortal life extended through virtually infinity time…. According to current theory, the universe, which is now expanding, collapses in on itself in time, ultimately generating another "big bang" and beginning itself the new" (Alwes 403). This is close to my view, but I see Thomasina as more ambitious and Alwes off by some billions of years. Lucy Melbourne seems to project the same billions of years, in her essay "Plotting the Apple of Knowledge: Tom Stoppard's Arcadia as an Iterated Theatrical Algorithm." She writes "Time itself seems to disappear as the characters discuss the fate of the world …. 'Thomasina: No, if you set apart the minus routes they square back to sense' " (78). (Melbourne 570). Ms. Melbourne correctly identifies this key passage, but supposes we are to think of "a new universe could emerge from the ashes of the old." This is expected to take some billions years.

4 Plautus and Time Leakage

There are many examples of our all-at-once-and-nothing-first-spacetime continuum embracing the two periods in *Arcadia*. Plautus was vexed to nightmare by Septimus's claim that time will not run backwards. But just what does a tortoise have to do with cosmology? We don't need to prove here that Stoppard is a scholar of Einstein, but it seems unlikely that he was unaware of Stephen W. Hawking's 1988 bestseller *A Brief History of Time: From the Big Bang to Black Holes*. The briefest glance into Hawking explains our tortoise. His very first words are these:

> A well-known scientist (some say it was Bertrand Russell) [others say William James] once gave a public lecture on astronomy. He described how the earth orbits around the sun and the sun orbits around the center of a vast collection of stars called our galaxy. At the end of the lecture a little old lady at the back of the room stood up and said: "What you have told us is rubbish. The world is really a flat plate supported on the back of a giant tortoise." The scientist gave a superior smile before replying "What is the tortoise standing on." "You're very clever young man, very clever," said the old lady. "But it's turtles all the way down."

(Hawking BHOT 1)

Stoppard has made a direct reference to these turtles in his 2015 play *The Hard Problem.* The […] science has no underneath, it's tortoises all the way down" (*The Hard Problem 14).* One more well-known mid-19th-century turtle, the Mock Turtle, a pal of another 19th charmer, may have influenced Stoppard's thinking in *Arcadia*, but we will get to that.

Plautus the tortoise (later called Lightning) is the subject of some ten stage directions or other mentions in 1809, 1812, 1832, 1834, and the present, a fair number since we never see him speak, move or actually eat. Plautus is our repeated clue that in *Arcadia* time is an illusion, as he (or it) appears in every scene but the sixth (though he must have been, on the table).

The tortoise is named after the Roman playwright Titus Macias Plautus (254-184 BC). A famous quote from Plautus, "He whom the gods love dies young […]" (Plautus, Bacchides, IV, 7, 18), might make the audience suspect some young person on this stage is going to die before the final curtain, so maybe we are looking at a tragedy in *Arcadia* here, but on second thought maybe the mention of Plautus is also a reference to Hamlet, where Polonius praises the players:

> The best actors in the world, either for tragedy,
> comedy, history, pastoral, pastoral-comical,
> historical-pastoral, tragical-historical, tragical-
> comical-historical-pastoral, […]:
> Seneca cannot be too heavy, nor
> Plautus too light.   (Hamlet II 2 396-402)

A freshly picked apple, retaining some leaves, having figured in Scene Two, the present, is somehow on the table when Scene Three begins, back in the the 19th century. Septimus slices up the apple and eats it, offering Plautus a slice. (34) The apple slice is a spacetime slice of the continuum loaf. As we have seen, Septimus had to reprove Plautus for rejecting Newton in favor Spacetime. Spacetime slices are illustrated again in Scene Five, the present, when Valentine insists on feeding the tortoise shreds of lettuce from his sandwich while Bernard bloviates.

In Scene Seven all the spacetime slices openly mix, with with characters from both periods on the stage at the same time, some even sitting at the same table.

5 Thomasina's Discovery I

Thomasina, certainly young enough for Plautus's purposes, having pointed out to us the pre-curtain Big Bang, continues her tour of the spacetime continuum in Scene One by complaining that she can stir a spoonful of jam into her pudding but not out.

With Plautus on the table, at the start the of Scene Two, thee present-day Bernard, in his first appearance, hears the shotgun blasts from Scene One. Bernard has brought a bogus algorithm about Byron to Sidley Park and as soon as he is alone on the stage we have this: "[S.D.] (There is the distant "pop-pop" of a shotgun [.…] It takes Bernard vaguely to the window [.…] Gus looks in [.…]" (17). This is a reprise, from Scene One (13); the 19th century hunt scene, and it's reference to relativity, is so persistent and so close in the continuum that we, and Bernard, can hear it. This is also the first appearance of Augustus/Gus, as he checks to see if the "rake and hypocrite" (69) who claimed his hare/pigeon in 1809 (13, 79) has returned. He has.

A more bizarre example of the spacetime slices of the continuum but more certain, probably because we are getting used to it, is the out-of-sequence and aborted start of Scene Six actually page 67 [19th Century], offstage, at the end of Scene Four [20th Century] page 52:

> [S. D.] (*The empty room.The light changes to early morning. From a long way
> off, there is a pistol shot. A moment later there is the cry of dozens of crows disturbed from
> the unseen* trees) (52).
> The material in italics is summarized in the stage directions at the start of Scene Six:
> (*The room is empty.A reprise: early morning—a distant pistol shot
> —the sound of crows [.…]*) (67).

This evidence of the spacetime continuum tells us the universe doesn't operate as it seems to, at least not in *Arcadia.* There is much continuum leakage, but perhaps the most direct assertion that time is an illusion is the way Scene Seven takes place; five characters from the 19th century and five from the present appear onstage from moment to moment, a mixed group five even seat themselves at the table at the same time. A present day character, Hannah, pours herself a drink of wine from a decanter and into a glass we have just seen Septimus bring on stage in 1812 (93), as they all talking about the same ideas, referring to the same notebooks and drawings. Then characters finally dance the same dance (97) to the same music, from the 1812 piano.

An audience accepting the illusory nature of past, present, and future, if only provisionally, and the scientific ideas that accompany them, may form conclusions about the purpose of these shifts and mixing of centuries. I suggest the emphasis on mixed time illustrates the spacetime continuum that simply exists. We still don't need to prove here that Stoppard is a scholar of Einstein, but to dipping into Hawking again we find, "The laws of science do not distinguish between forward and backward directions of time" (Hawking 152). Though Aristotle, Newton, Leibniz, are mentioned among other early scientists, Einstein and Hawking are the only late 19th- or 20th-century physicists implicated in *Arcadia.*

6 Thomasina's Discovery II

Arcadia is clearly in the tragical-comical-historical-pastoral vein and Polonius is our link to that dread of something after death which stayed Hamlet's hand from self-slaughter, in our case the fire Thomasina goes to. Septimus, in Scene Seven, unintentionally opens the way to a consummation devoutly to be wished when he provides the answer to Hamlet, saying: "When we have found all the mysteries"(94), clearing away Shakespeare's case against suicide and releasing Thomasina to die by her own hand.

The various characters in the present day scenes are mostly foils. Valentine critiques and then vets the world according to Thomasina, his great, great auntie; Hannah is a mostly calm and steady researcher, though frequently baffled, who asks good questions; Bernard and Chloe offer comic relief and, near the end (95), offstage interrupted sex.

Having had the first Big Bang, in the gazebo, explained to her, in Scene One, Thomasina, perhaps thinking this does not fit well into a clockwork universe and annoyed about the jam-pudding problem, asks a follow-up question: "Septimus, do you think God is a Newtonian?" (5).
Here Septimus uses each of her early questions as an excuse to mock her pretended ignorance, but by the end of the play she has found the proper answers. She has moved way beyond the Newtonian ideas of Septimus, and wants him to join her in escaping time: saying "You may", and "Then I will not go" (96).

It is easy for the audience to believe whatever Thomasina believes because she is so learned and bright:

--Her tutor, to distract her for awhile, sets her to solving Fermat's Last Theorem, (2).
--She embarrasses him into explaining carnal embrace, (3).
--When complaining about her jam, she compares the mixture to "the picture of a meteor in my astronomical atlas" (3-4), thus showing off her interest in the cosmos and Newton. After a little of his teasing, but no answer, Thomasina states her "Discovery:"

> If you could stop every atom in its position and direction, and if your mind could
> comprehend all the actions thus suspended, then if you were really, really, good at algebra,
> you could write the formula of all the future; and although nobody could be so clever as
> to do it, the formula must exist just as if one could. (5)

He is not impressed, calling it a "fancy," but she sticks to it, revises it, and pursues a post-Newton cosmology for the rest of her life.

Soon, still in Scene One, with her daughter in search of a formula for all the future the gorgeous and fabulous Lady Croom introduces special relativity into Thomasina's education while critiquing gardener Noakes's picturesque style. She says Noakes "has read too many novels by Mrs. Radcliffe, that is my opinion. This is a garden for *The Castle of Otranto,* or the *Mysteries of Udolpho*—" (13). She is interrupted when Chater bleats, "*The Castle of Otranto*, my lady, is by Horace Walpole."

Lady Croom responds: "Mr. Chater, you are a welcome guest at Sidley Park but while you are one, The Castle of Otranto was written by whomsoever I say it was, otherwise what is the point of being a guest or haging one?" [This is a taste of the whip she applies to Byron *et al* in Scene Six.] Noakes interjects [to no effect] "Mr. Walpole the gardener?"

Then S.D. "(*The distant popping of guns heard.)* […] Lady Croom: (*She stands looking out.*) "Ah![....]Your friend [Byron] has got down a pigeon [herself?]. (*Calls out.*) Bravo, sir! .[…] Brice: (*Looking out.)* Yes, to Augustus!--bravo lad!" (13).

In two quick strokes, one involving authorship and relativity of social position, one involving marksmanship and the relativity of simultaneity, Stoppard has serve to reminded the audience of Einstein's 1905 theory of the relativity of space and time. We needn't dilate here on the relative social positions of Lady Croom and Mr. Chater, but the second example reminds us that observers views of events can vary depending on the observer's position or motion. Please note that those closest to the action, "Self--Augustus--Lord Byron […]" (54), all agree it was a hare, though not on who killed it. Thomasina now underscores the simply existing continuum and Poussin, saying "Phooey to Death!, and mischievously draws in a hermit on Noakes's watercolor of the proposed Sidley Park hermitage (14). Thomasina's drawing, "I have made him like the Baptist, in the wilderness" (14)**.** Her Baptist heralds the end of Newtonian physics and the beginning of relativity. Stoppard has set Thomasina on her search for a new cosmology; as to what this will be, do we have to look far?

When Thomasina announces her "discovery" it sounds very advanced, but in moment we see it is the merest start. She has glided right over the hard problem "if your mind could comprehend all the actions thus suspended…." Newton and Einstein differ how they worked out the "hard problem." The business with the Baptist shows she throws her lot in with Einstein and begins to leave her tutor behind. Accordingly, in Scene Two Stoppard introduces the scribbling hermit. He is Septimus, who had survived her, as he would rather bear those ills we have/then fly to others that we know not of. Hannah says her research reveals that a studious hermit died in 1834, having lived in the Sidley Park hermitage (26). She has not yet any idea that he was Septimus. " 'The cottage [the hermitage] was stacked solid with paper' " (27); which was burned in a " 'bonfire' " (28). Later she and Bernard peruse a publication called "Peaks Traveller and Gazetteer," with an entry [the entry is imaginary, and maybe the gazetteer as well] on Sidley Park from which Hannah reads:[...]

> [A] hermitage occupied by a lunatic since twenty years without discourse or companion save for a pet tortoise, Plautus by name [....] (64)'[I]t was Frenchified mathematick [sic] that brought him to the melancholy certitude of a world without light or life…as a wooden stove that must consume itself until ash and stove are as one, and heat is gone from the earth.' [….] He died […] hoary as Job and meager as a cabbage stalk, the proof of his prediction even yet unyielding to his labors for the restitution of hope through good English algebra.   (65)

This quote from the hypothetical visitor to Sidley Park is not a mathematical proposition, but rather just Stoppard's dig at Englishmen's irrepressible to urge to show themselves superior to the French. Samuel Johnson should suffice—"A Frenchman must always be talking, whether he knows anything of the matter or not," Boswell's Life, vol. iv, p. 15 1780. The hermit is Septimus okay, trying to find out if Thomasina is right to kick God out of her equations, assume that time is an illusion, and die young.

The hermit is, though not insane, at least driven and dies so (65). He has made a 22-year effort to understand and then perhaps to follow Thomasina's final leap, her self-immolation after Scene Seven. Their physics part ways when, in Scene Three, he answers her demand for an equation for a bluebell, by saying God has "mastery of equations which lead into infinities where we cannot follow" (37). Now she shows the power of her intellect. A true English logician, she will not rely on God to explain anything. "Thomasina: What a faint heart! We must work outward from the middle of the maze. We will start with something simple. [S.D.] "(*She picks up the apple leaf.*) I will plot this leaf and deduce its equation." (37). (Now we know why April 10th is the start date of *Arcadia*: it is the Day of Commemoration of William of Occam.) As she was only 13, Thomasina did not know that no faint heart was going to accompany her on any final leap.

This onward-and-upward speech delivered, the two return to an interrupted Latin lesson which has already included this language: "seated on a throne…in the fire […]" (35) and a stage direction saying that he has sealing wax and the means to melt it. "Back to Cleopatra" he says (38), and soon picks up the translation, he has himself translated, Shakespeare into Latin, "[…] burned on the water[…]" (39), and we have lots of fire with literature's best known suicide, not mentioned here by mistake.. All these flames and Cleopatra foreshadow Thomasina's self-immolation. And there is subtext hinting at her young passion for Septimus: "Thomasina: … Was like as to—something—by, with or from lovers [this covers the subject]—oh, Septimus! […]…the silver oars—exciting the ocean—as if—as if—amorous—" (35).

Offstage after Scene Three, but before she returns in Scene Seven, three years later, she writes about her discovery of a "Geometry of Irregular Forms", now refined to cover all the forms of nature (the universe), into a margin in Septimus's mathematics primer [a la Fermat]. We learn this when in the present day Hannah reads aloud at the start of Scene Four:

[Author's note: I cannot remove this line of dots.]

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> I, Thomasina Coverly, have discovered a truly wonderful method whereby all the forms of nature must give up their numerical secrets and draw themselves through number alone. This margin being too mean for my purpose, the reader must look elsewhere for the New Geometry of Irregular Forms discovered by Thomasina Coverly.   (43)

7 The Coverly Set: Valentine and Thomasina

By Scene Seven Valentine, at the table with Hannah, is seen "pecking at a portable computer," working on a "set of points on a complex [imaginary] plane made by—[….] The Coverly Set" (75-76) he says. In a minute Hannah looks over Valentine's shoulder at his computer screen: "Hannah: Oh!, but …how beautiful! Valentine: The Coverly set." Having pushed Thomasina's algorithm through his laptop many times, Valentine tells Hannah:

> See? In an ocean of ashes, islands of order. Patterns making themselves out of nothing.
> I can't show you how deep it goes. Each picture is a detail of the previous one, blown up.
> And so on. For ever. Pretty nice, eh? [….] Interesting. Publishable [….] [S.D.] *From*
> *the old portfolio he takes Thomasina's lesson book and gives it to Hannah [….]*) (76).

Now Stoppard sets the hook with a sharp jerk. Thomasina, Thomasina the entirely wonderful, Stoppard's Fanny Price, his, Emma, his Lizzie, died at 16, very shortly after writing these equations. Woe is us. We had nothing particular in mind for her, but certainly not this. She burned to death in her bedroom the eve of her 17th birthday. There is a memorial in the Park (76). An explanation for this early death is required of any critic of this play. Explanations including the word tragic may be returned unopened.

Hannah looks through the lesson book again and Valentine returns to his laptop. As they sit there Augustus, Thomasina, and then Septimus come into the schoolroom [in the 19th century] and, after a little sibling disorder, all also seat themselves at the table Hannah, Valentine, Thomasina, Septimus and Augustus are all seated at the table and neither date group is aware of the other. Thomasina gets back her rabbit equation homework, in the lesson book, returned by her tutor; she and Septimus, and Valentine and Hannah, all look at her equation in the "surviving" and original the lesson book.

"Thomasina: No marks! Did you not like my rabbit equation? Septimus: I saw no resemblance to a rabbit. Thomasina: It eats its own progeny" (77). Septimus: S.D. (*Pause.*) I did not see that.[S.D.] (*He extends his hand for the lesson book. She returns it to him.*) Thomasina: I have not room to extend it" (78).

> Hannah**:** [Looking at the equations and apropos Valentine's "The future is disorder.", back on page 48.]
> Do you mean the world is saved after all?
> Valentine: No, it's still doomed. But if this is how it started, perhaps it's how the next one will come.
> Hannah: From good English algebra?" (78).
> Septimus: It will go to infinity or zero, or nonsense.
> Thomasina: No, if you set apart the minus roots they square back to sense" (78).
> [See "Septimus: God has mastery of equations which lead into infinities where we cannot
> follow" (37).]

Septimus goes back to her rabbit equation; she starts drawing.

This is the second mention of complex numbers, Valentine has already (75) described Thomasina's Coverly set as "a set points on a complex plane [….] ." complex numbers in the Coverly Set. What does this mean? Thomasina, working outward from the middle, her leaf, has been iterating an algorithm Valentine says depicts patterns making themselves out of nothing--expansion after the Big Bang. She's been utilizing what she calls "minus roots," imaginary numbers [a term coined in derision by Rene Descartes in 1637], that is numbers expressed using the square root of -1, or *i*, or the root of any minus number [see high school algebra]. Imaginary numbers have been known as part of algebra since the 16th century, but it wasn't until 40 years after Thomasina began to describe her leaf that Bernard Riemann (1826-66) published his "Riemann Surface;" or complex plane, which as usually illustrated as made up of leaves.

[Bernhard Riemann, in full Georg Friedrich Bernhard Riemann   (born September 17, 1826, Breselenz, Hanover [Germany]—died July 20, 1866, Selasca, Italy), German mathematician whose profound and novel approaches to the study of geometry laid the mathematical foundation for Albert Einstein's theory of relativity. *Britannica.com*]

The Riemann surface, or complex plane, of the square root, showing how the two "leaves" fit together.
[Readers who think this is a coincidence may stop here.]
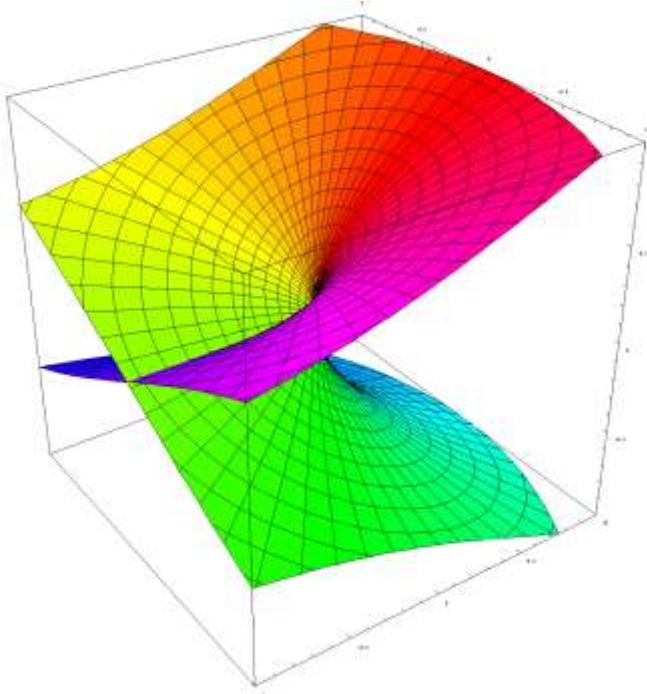
Thomasina's iterated algorithm shows she has now leaped to the middle of relativity and even quantum theory, and here is the meaning of "Oh, phooey to Death!" Hawking says any unified theory must include the ideas of Richard P. Feynman (1918-1988) a 1965 American Nobel Prize laureate in physics: Hawking—"That is to say, for the purposes of the calculation, one must measure time using imaginary numbers, rather than real ones. This has an interesting effect on spacetime: the distinction between time and space disappears completely" (Hawking BHOT 133-134). If there is no time, what is death?

Thomasina is ready for a new leap and a way to test the validity of her emerging view that time is an illusion. Support for her alternative to Newton is also an urgent need. Important support arrives few minutes later when he shows her the 1811 a "prize essay" of the Scientific Academy in Paris. Septimus says, of the author, never   identified, " (…) for you are his

prophet. [….] He has discovered heresy—
--a natural contradiction of Sir Isaac Newton."

Reading the French essay herself, she leaps again, grasping and dismissing the second law of thermodynamics and embracing the end of determinism (83). She draws her heat diagram and he gives her new homework--"Explicate your drawing" (87).

Though he is never identified by Stoppard, Jean Baptist Joseph Fourier (1768-1830), was a key 19th century figure. We may remark the similarity of language used by Septimus and Jaroslov Sestak, a historian of science. "The birth of modern scientific thought probably occurred […] in 1811, when Fourier was awarded the prize of the French Academy of Sciences for the […] description of heat transfer in solids […] which put heat and gravity at a contradiction to one another," (Sestak 53). (The previous page of the same volume has illustrations of the Newcomen steam engine, 1705.) It was little noted at the time, but Fourier had knocked determinism into a cocked hat.

After she reads the Prize Essay by this 19th century John the Baptist, we have this exchange:

Thomasina: […] Determinism leaves the road at every corner, as I knew all along [….]
Lady Croom: Is this geometry?
Thomasina: This? No. I despise geometry [….]
Septimus: Geometry, Hobbes assures us in the Leviathan, is the only science God has been pleased to bestow on mankind.
Lady Croom: And what does he mean by it?
Septimus: Mr. Hobbes or God?
Lady Croom: I am sure I do not know what either means by it.
Thomasina: Oh, pooh to Hobbes!   (83-84)

Thomasina, having learned from her minus roots that time is an illusion, realizes death must be an illusion as well, and tells us so, "pooh" to nasty, brutish and short.

Septimus may think his student is saying is saying "pooh" to geometry, but she is really expanding on her "Oh, phooey to Death!" remark (13).

She adds, "There is another geometry [The New Geometry of Irregular Forms] which I am engaged in discovering by trial and error [the approach advocated by Valentine (46)] am I not, Septimus?" (84). She notes that she herself is making intuitive leaps, a talent she shared with the French Newton--Pierre-Simon, marquis de Laplace (1749-1827) the influential French scholar, whose work included a statement almost identical to Thomasina's tautological fancy, a restated and developed the nebular hypothesis of the origin of the solar system and was one of the first scientists to postulate the existence of black holes and the notion of gravitational collapse. He shared with Thomasina:

> [T]he ability with which he invented the necessary analysis is almost phenomenal. As long as his results were true he took but little trouble to explain the steps by which he arrived at them; he never studied elegance or symmetry in his processes,   (W.W.R. Ball 389)

Now she draws the heat diagram (85), based on her understanding of the Prize French Essay, and absorbs the implications of her mother's statement that it is time for her to marry. As Septimus gets the French essay back from Thomasina and [S. D.] (*He turns the pages and also continues to study Thomasina's diagram. He strokes the tortoise absently as he reads.*) (87). At the same time she draws "Septimus with Plautus."

Septimus now has all three items he will need for his calculations in the Hermitage: the maths primer, the lesson book, the and the heat diagram. [He already had Plautus.] In the hermitage for all the 22 years after the fire, with Plautus on his desk, Septimus strives to duplicate Thomasina's mastery of equations, demonstrated in Scene Seven, that she thinks will lead her into infinity, or Arcadia. The hermit is hoping to convince himself to believe as she thinks her equations teach her, "Oh, phooey to Death!" "Oh, pooh to Hobbes!"

8 Here I Am In Arcadia and Phooey To Poussin!

We meet the delightful Lady Croom, in Scene One, when she is about 34 years old, delivering her criticism of the new plans to make Sidley Park "picturesque" and explaining that her home is already picture perfect:

> –in short it is nature as God intended. And I can say with the painter, '*Et in Arcadia eg*o!' 'Here I am in Arcadia,' Thomasina.

> Thomasina: Yes. Mama, if you would have it so.   (12)

Lady Croom's translation cuts no ice with Thomasina, who reserves her own, saying, "…it was your geography caused the doubt." (12), but her mother's translation may be useful after all.

The painter Lady Croom refers to is of course Nicolas Poussin (1594-1665) who is represented at Chatsworth House by the first (1628) of his *Et in Arcadia ego* paintings, *The Arcadian Shepherds,* (Rosenberg and Christiansen Figure 70), 1628. We know the painting was available to the Croom family, as it had come into the collection of the Duke of Devonshire by 1753 and we learn in Scene Seven that the families were on visiting terms. Indeed Lady Croom sent the Duchess sent a potted West Indian dwarf dahlia at Chatsworth House and later visited her in London. (83)

'Erwin Panofsky in his *Meaning in the Visual Arts* credits Virgil with an innovation that would delight Lady Croom and the Chater and perhaps Thomasina: 'inexhaustible leisure for love in Arcadia' (Panofsky 299). ,

"Even in Arcadia, there am I" is the only proper translation of the Latin, says Panofsky —and the shepherds in the Giovanni Francesco Guercino picture of the same scene (1621-23), and those in the Chatsworth Poussin have been suddenly interrupted in their happy pursuits and are being advised to beware of coming to a bad end (Panofsky 315). For Thomasina, being interrupted in her happy pursuits by marriage to a man selected by her mother would decidedly be a bad end. For further evidence that Thomasina knows the Chatsworth collection consider her reference to "Salvator," on page 10. "In my opinion Mr. Noakes's scheme of the garden is perfect. It is a Salvator."

Salvator Rosa (1615-1673) painted *Landscape with Jacob's Dream* (Oil on canvas) around 1665. The painting depicting the story of Jacob's ladder to heaven (Genesis 28:10-19), along with a ruined castle, or at least a watchtower, was recorded in the collection of the Duke of Devonshire by 1761.

The meaning of "Phooey to Death!" may be discovered at the end of Panofsky's Poussin essay when he draws our attention to the great Jean-Honoree Nicolas Fragonard (1732-1806) who dealt with the undiscovered country around 1770 in a large drawing called "The Kiss," (Vienna, Albertan), (Rosenberg Plate 247).

Rosenberg wrote of this drawing "Love is plunging his torch into the remains of an ancient Roman sarcophagus while an embracing couple is reborn from the ashes in a funeral urn [...]" (Rosenberg 498). He asserts that the drawing illustrates this line from Horace: "Love still breathes and passions still smolder which the Aeolian girl (Sappho) confided to the strings of her lute" (Rosenberg 498).

Panofsky's essay concludes "To Guercino's 'Even in Arcady there is death,' Fragonard's drawing replies: 'Even in death there may be Arcady,' " (Panofsky 320). Or, " 'Here I am in Acadia!' Thomasina."

Lady Croom and the others take themselves off, and our couple is alone again, and comments on the hunt passing nearby, "Pop, pop, pop…." (13) And Septimus provides the accepted translation, "Even in Arcadia, there am I!" (13). In this translation "I" is death. Thomasina then makes the remarkable response, "Oh, phooey to Death" (13). The child is beginning to believe she will not die.

9 Hawking and Beyond

Stoppard has Hannah mention Einstein and relativity twice. In Scene Four she remarks of iterating algorithms "What I don't understand is … why nobody did this feedback thing before—it's not like relativity, you don't have to be Einstein" (51)." In Scene Five she says men can only deal with two thoughts each: Bernard—"Sex and literature [….] Einstein—relativity and sex" (63).

As we saw (this essay, p. 2) Hawking says, "the laws of science do not distinguish between forward and backward directions of time" (Hawking 152). And the repeated time leakage in *Arcadia* shows us this is a key problem for Septimus the Hermit. In his book The Fabric of the Cosmos Brian R. Greene a celebrated Oxford trained physicist, now a professor at Columbia, elaborated somewhat the idea,: "A less then widely appreciated implication of Einstein's work is that special relativistic reality treats all times equally [...] every moment is a real as any other" (Greene 131). Or, as Max Tegmark of MIT puts it, the flow of time being an illusion we can think of "a four-dimensional place called spacetime that simply exists, unchanging, never created, and never destroyed" (Tegmark, 1). This is also the view of Paul Davies, a theoretical physicist at the Australian center for astrobiology at Macquarie university in Sydney. "Objectively, past present and future must be equally real. All of eternity is laid out in a four-dimensional block composed of time and the three spatial dimensions, (Davies 43). Could Thomasina have leapt this far? High school algebra was all Einstein needed to lay out "the argument for special relativity," as Green points out (Greene 47) and as can be seen in the equations themselves in A Stubbornly persistent illusion: The essential scientific works of Albert Einstein: Edited by Stephen Hawking. This illusion occupies Septimus for 22 years.

Well, our Thomasina has algebra. "It's not the depth of mathematics that makes Einstein's special relatively challenging, it is the degree to which the ideas are foreign and apparently inconsistent with every day experiences" (Greene 47). "Even though experience reveals over and over again that there is an arrow of how events unfold in time, this arrow seems not to be found in the fundamental laws of physics," (Greene 145). The absence of this arrow is a serious problem for the logic sustaining the 2nd law, ever increasing entropy, according to Huw Price, Bertrand Russell Professor of Philosophy and a Fellow of Trinity College at the University of Cambridge. In 1988 Hawking wrote this appeal to logic, "The second law of thermodynamics [ever increasing entropy] results from the fact that there are always many more disordered states then there are ordered ones" (Hawking BHOT 145). But is this logical? Price, writing in *Nature* in 1989, said the 2nd law leads to a dilemma which "stems from the fact that the universe need not always expand," (Price 281). George Musser, discussing Price's ideas in 2002 in *Scientific American*, also undermined the Hawking's logic saying, "The basic idea is that there are more ways for a system to be disordered then to be ordered. If the system is fairly ordered now it will probably be more disordered a moment from now. This reasoning however is symmetric in time. The system was probably more disordered a moment ago" (Musser 49).

But Septimus, when they meet again in the final Scene Seven, a week later, and for the last time, has not absorbed the significance of the "minus roots" in the Rabbit Equation. Having read her heat essay, which does not survive, he says, "When we have found all the mysteries and lost all the meaning, we will be alone, on an empty shore," probably a reference to H.G. Wells *The Time Machine*, 1895, and she responds "Then we will dance. Is this a waltz?" (94) She dismisses the 2nd law because she has realized that if there is no time there can be no asymmetry of time, as the 2nd law would require. But she can't explain this dismissal until she has shown him there is no time, which she plans to do after carnal embrace. So when she runs him to ground and kisses him, late at night, barefoot in her nightgown, the kiss is not an invitation to debate the 2nd law. She is trying to get him to take her in his arms, her purpose here, as she has told him from her entrance (91).

She has divined most of our best physical model, the Big Bang and the spacetime continuum, aided by French mathematics and painting, after working outward from the middle—that is from the apple leaf that just arrived in 1809 from the present (34). These leaps past Fourier and Riemann to Einstein are prodigious indeed and we see she has made them when Stoppard has her say the "minus roots square back to sense," and "Oh pooh to Hobbes," meaning "It may be nasty and brutal, but it isn't short," as her new geometry shows. We must notice these leaps "by the way," as she noticed the 2nd law of thermodynamics (87).

Stoppard has brought the cosmology of the present onto the stage with a very smart "schoolgirl" who by the middle of Scene Seven, smart as she is, must consider if the knowledge that spacetime is unchanging will help her escape a mother's pressure to marry; and what a mother.

As this seventh scene continues we can see that they are ready for carnal embrace. Septimus has kissed her in the hermitage, which has now replaced the scene of the Big Bang, the gazebo, and become a place of assignation in its stead. As the seventh scene continues we can see that whatever the cosmos is up to this couple is close to fulfilling Thomasina's prophesy of thinking of him when she practices carnal embrace. She neglects to consider, that he has told her carnal embrace addles the brain (14), or as Tolstoy described Prince Andre's reaction to first dancing with Natasha: "…scarcely had he embraced that slender supple figure and felt her stirring so close to him and smiling so near him than the wine of her charm rose to his head…."

Lady Croom has already turned up the heat on her daughter, that not provided by Thomasina's working outward from the middle, by saying things like "we must have you married before you are educated beyond eligibility" (84) and "then this [education] business is over. I was married at 17" (86). For Thomasina these remarks are ominous. She knows her mother's whims are outrageous. In Scene Six, in the middle of the night, Lady Croom brusquely dismissed Lord Byron from Sidley Park (though she had taken him as a lover, or was about to), along with her rival, Charity Chater, her own brother, Capt. Edward Brice RN, and Ezra Chater, rather than share Byron with Charity. Lady Croom was looking to dispatch Septimus as well but he managed to seduce her instead. Thomasina knows she can't leave her faith in the hands of Lady Croom..

Thomasina can guess what sort of husband her mother might choose for her, someone like her own father the mighty slayer of birds and rabbits, Brice the sex fiend, Chater the cuckold, or the Polish count/piano tuner, with whom Lady Croom is presently infatuated. Her "I was married at 17" speech concludes with this: "*Ce soir il faut qu'on parle francais. Je te demande*, Thomasina, as a courtesy to the Count. Wear your green velvet, please, I will send Briggs to do your hair. Sixteen and eleven months…!" (87). Is Lady Croom planning to use Thomasina as a lure to keep the count available? The audience might recognize that "send Briggs to do your hair:" it is a lift from Lady Bertram's "I sent Chapman to her," in Jane Austen's Mansfield Park, of about even date with Lady Croom, where Fanny is given the coming-out party that leads to an odious marriage proposal from Crawford, who, rejected, soon seduces Fanny's married cousin away from her perfect (rich, fat and stupid) husband. Mansfield Park also mentions the real Humphry Repton (10) sort of model for Noakes, amid a discussion of improving estates by cutting down avenues of trees.

If Thomasina marries somebody picked by her capricious mother it will amount to accepting the slings and arrows of outrageous fortune. But Thomasina has decided she has another choice. She thinks she can find her way to the Arcadia where Plautus, the apple, the leaves, the wine, the music and Augustus/Gus, all be-sport themselves.

When she returns six days later 'to dance', she is ready test her ideas by dying herself, but she will try to persuade Septimus to die with her. She "runs Septimus to ground" as the Chater did for their Big Bang (7). She is thinking "phooey to death" again and has been searching for Septimus to achieve an embrace devoutly to be wished.

For these purposes Thomasina comes to Septimus barefoot and in her nightgown (91) as if to give us the love scene we have been expecting since Scene One, when he clinically explains carnal embrace and she says, "Eurghhh! [No doubt a regency idiom.] Now when I am grown to practice it myself I shall never do so without thinking of you" (3), a remark which now looks like turning out to be true. Septimus has responded, "Thank you very much, my lady" (3). Now, in the final scene, she wants him to join her in the Big Leap. She is sexy, brilliant, rich, and he admires her greatly, despite his two dalliances that we know of, including the Big Bang and her own mother.

He makes her wait for her demanded dance lesson, for which she pays a kiss in advance, while he reads her last essay and as the piano that earlier (41, 43) heralded her "discovery" plays in the next room (91). He asks her, "So, we are all doomed!" She answers "(Cheerfully) Yes" (93). He: "[W]e will be alone on an empty shore." Her: "Then we will dance. Is this a waltz?" (94) Thomasina means to complete her education with him and she is not worrying about her mother or entropy, because she has made yet more leaps since we saw her last, six days before, and in this time she has turned in her heat essay, made a final decision, and planned her last hours as a person, a natural philosopher and a virgin. Anticipating Einstein she has concluded time is an illusion and so necessarily all time exists at once--and she and Septimus can die without fear tonight and go on living still in all the time-slices of their lives,escaping her mother's marriage plans. Her plans laid, she needs to complete her sex education with Septimus and then talk this faint heart into joining her in death. There is an additional advantage to avoiding her mother's plans: there would be no time-slice in which he will cheat on her or her on him, a common theme in *Arcadia.*

Though her heat essay would leave Septimus on the lonely shore she understood that heat exchange is only part of the story. Having arrived at this hypothesis, Thomasina is much too smart to fall into the trap of attempting proof by induction, and in any case, "She didn't have the maths, not remotely" (93). But she could try what we now call "falsification." This is the notion that we can never prove a universal theory by any series of supporting observations, but can show such a theory to be false by one observation which runs counter to the theory. "Falsification can get a grip where positive proof is beyond us." ("Popper, Karl." Oxford Companion to Philosophy. 1995)

With her plans formed, she means to sacrifice herself to cheerfully prove the spacetime continuum simply exists, moving way beyond Septimus's fixation with H. G. Wells's empty shore. Recalling her mother's remarks the "The Chater would overthrow the Newtonian system in a weekend" (84) and "I hope I am more than a match for Mrs. Chater with her head in a bucket" (72) Thomasina is confident she can overthrow Septimus's God based ideas in one night of carnal embrace. After she has addled his brains there will be time enough to convince him that they will live forever in the spacetime continuum Stoppard has imagined for us with the waltzing pairs, the 20th century party music that comes through to the 19th century, as did the apple and its leaves, while Plautus, Augustus/Gus and a decanter of wine and a glass go forward to the present day.

Thomasina's problems have been reduced to getting Septimus into her arms and in a little more malleable mood. She is repeatedly after him to hold her and dance.

Bernard was right when he said in Scene Five, "A tortoise. They must be a feature." And with the help of Hawking's turtles and Plautus, even if the audience has never heard of Fourier and can't imagine the square root of minus one, we know that she has something to tell him about change and death but she wants him fully relaxed first. Her asking him to dance at least six times.

lets us interpolate another featured tortoise:

> Will you, won't you, will you, won't you, will you join the dance? […]
> "You can really have no notion how delightful it will be
> When they take us up and throw us, with the lobsters, out to sea!"
> But the snail replied "too far, too far!" And gave a look askance –[…]
> "What matters it how far we go?" his scaly friend replied.
> There is another shore, you know, upon the other side.
> The further off from England the nearer is to France.
> <div align="center">(Lewis Carroll: "The Mock Turtle's song."</div>

Stoppard has made a more direct reference to Lewis Carroll's "The Walrus and the Carpenter, *"*And answer came there none," in his 2015 play <u>The Hard Problem</u> (14).

For herself Thomasina is now ready to take arms against a sea of troubles and by opposing end them. She starts by kissing him, urging him to teach her to waltz, "I cannot be seventeen and not waltz [...] the house is all abed […] Oh, Septimus, teach me now."

Hannah and then Valentine enter, Valentine to the table where the others sit. We have the 2nd law interlude.

Finally they start to dance the waltz, the first dance danced in polite society that allowed couples to embrace and Stoppard gives us another hint: they dance to the 20th century music from the costume party outside, the new improved music of the spheres.

Septimus and Thomasina do not seem to be losing any heat as Bernard and then Chloe burst in, their offstage love-making in the hermitage interrupted. The bookend Big Bang the audience must by now expect will have to involve the leading couple, as we have known since she said "carnal embrace."

After they have danced for a bit— [S. D.] (*Septimus, holding Thomasina, kisses her on the month. The waltz lesson pauses. She looks at him. He kisses her again, in earnest. She puts her arms round him.*)

Thomasina: Septimus…
        (*Septimus hushes her. They start to dance again.*) (94).

 Thomasina and Septimus waltz a while longer and pause again. He relights her candlestick, saying, "Take your essay. I have given it an Alpha in blind faith" (96). [And we learn why this essay, the hardest homework and the most illuminating, does not survive. It got burned up.] And they deliver their last lines:

> Septimus: Be careful of the flame
> Thomasina: I will wait for you to come.
> Septimus: I cannot.
> Thomasina: You may.
> Septimus: I may not.
> Thomasina: You must.
> Septimus: I will not.
> (*She puts the candlestick and essay on the table*.)
> Thomasina: Then I will not go. Once more, for my birthday.
> (*Septimus and Thomasina start to waltz together.) (96)*
>
> And after a few moments Gus and Hannah join them and all dance S.D. ([…] to the piano**.)**
>
> THE PLAY ENDS

10 Conclusion

What are we to believe but that Thomasina and Septimus retire to her bedroom, with the candle, and her essay, and enjoy carnal embrace? Can we guess what final insights she confided to Septimus in bed, as Chloe would have it that "Byron told Mrs. Chater in bed" (57)? Then, ready to test her theory, she fires the bed curtains. He, certain that the flames at least are no illusion, flees the fire, consumed with fear, then shame and guilt, which drive him to retire into the hermitage to consider what between them they have wrought. He turns to calculations, but he is not worrying about maximum disorder. Septimus's good English algebra is aimed at convincing himself that all time is happening at once and that she has gone to enjoy her time slices. From the fire after the tutor's death, Augustus reserved the maths primer, the lesson book, the heat diagram; along with his sister's portrait of her lover and Plautus. Thomasina's little brother hoped, correctly it turned out, that, given these clues someone would figure it out. Even though we don't know that Septimus solved the problem,, if she is right he must have eventually joined her, if a little late.

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