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Riemannian Reading: Using Manifolds to Calculate and Unfold Narrative

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Riemannian Reading: Using Manifolds to Calculate and Unfold

Narrative

(TITLE)

BY

Heather Lamb

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*This work is dedicated to every person, path, and moment that
led us here—to this place.*

Abstract

The purpose of this study is to investigate the space where readers and texts interact. By applying non-Euclidean geometry to the modern subgenre of science fiction known as steampunk, we can see that narratives have no intrinsic geometry. Instead, what we can understand is that readers unflatten inherently flat narratives by applying their own metric of understanding to a narrative. Steampunk acts a primer to considering this mathematical process by explicitly flattening its settings and characters, as well as the historical accounts founding the narrative. Mark Hodder's novel, *The Strange Affair of Spring-Heeled Jack*, offers two characters that unsuccessfully attempt to act as non-Euclidean readers. Through manipulation of agency, Hodder's novel demonstrates the unflattening process as we read novels. However, our unflattening process distorts a narrative through the application of our metric of understanding. The study first gives a short historical account of non-Euclidean geometry in the 19th century. The analysis stems from the application of non-Euclidean geometric thinking to narrative structures.

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Introduction:

The Geometrics of Literature

In 2016, Himanshu and Arul Mishra published a study that considered the importance of time and reward in the human decision-making process. By coupling Gaussian assumptions of space curvature with economic theory and praxis, like discount modeling, their study concluded that “the decision space is a Riemannian space with constant Negative Curvature” (Mishra 19). To help understand what this means, Bernhard Riemann, a pioneer of non-Euclidean geometry, proposed in 1854 that space has no intrinsic geometry. Instead, space is more akin to a continuum of points or coordinates. Since such a space has no intrinsic geometry, we create assumptions about the distance measured between two points in order to select a metric, or measurement. The metric we use to measure the distance between the points is only determined valid when the surface of the space being examined is revealed. To choose a metric more accurately, mathematicians use a Gaussian curvature, which distinguishes between flat and curved surfaces by measuring the magnitude of the curvature: “the magnitude of (K) tells us how much the surface is bending” (Mishra 5). The magnitude of the manifold, or “manifoldness,” describes an object mathematically. To simplify the concept, we give space geometry by choosing and giving metric.

Mishra and Mishra’s study is innovative in that it contends the notion of thought and thought-space as primarily functioning under

Euclidean space and mathematics, and it offers a counter via a non-linear, non-Euclidean thought-space that explains decision making behavior that can only have coherence to the individual making the decision. The researchers use algorithms and place metric on their participants' decision-making spaces, and they conclude by arguing that our perceptions of decisions made by others are flawed because our chosen metric may not fit the space or curvature that constructs the inter-temporal space of the decision maker. To us, someone may act irrationally or abnormally because our metric does not correctly predict the curvature of their decision-space: "Therefore, if we identify the right geometry underlying their decision space, we would see that they are actually responding normatively" (Mishra 20).

The application of mathematics to describe and predict human behavior is endless, and the literature surrounding behavior prediction with mathematics is exhaustive. What I find to be more innovative, and perhaps slightly sinister, about the 2016 study is that it hints at the complex idea of human beings understanding each other, or rather the problems created when attempting to understand or interpret others. As Riemann outlines, and Mishra and Mishra mention, when a surface does not verify the metric used, the measurements taken and used to determine a more accurate metric are distorted. For instance, if we use a ruler to measure a lemon, our measurement is less accurate than a tape measure or a string: the measurement given by the ruler is distorted. While Mishra

and Mishra can empirically test the veracity of their metric, their experiment seems to stop at a point of decision making that is immeasurable. They cannot visually observe the internal thought-space of another person. Perhaps the physical limitations forced their experiment to reduce their conclusions to how we *perceive* the decisions of other people.

Drawing from their experiment, then, I ask this: if non-Euclidean geometry, specifically Riemannian-space manifolds, can describe the abstract inter-temporal decision space of the human mind and draw conclusions about its process of crafting decisions, can it offer insight into the interaction between us and literature? The way in which I would like to attack this question is through Mark Hodder's steampunk novel, *The Strange Affair of Spring-Heeled Jack* (2010). Hodder's novel offers a good way to answer this question by confiscating the agency of the reader and both flattening and unflattening its own characters and settings. Hodder's novel applies its own metric of understanding and manipulates history in the process, distorting history through fiction. He then offers models of unsuccessful non-Euclidean reader-characters by juxtaposing their faults and limitations as readers, faults which are also *ours* as readers. Hodder's steampunk novel creates its own distortion to remark on how our interpretation distorts the space of a narrative.

The intersection of literature and mathematics is a field that is in its infancy. The most relevant scholarship regarding mathematics and literature, written by Wolfgang Funk in *Critical Survey* (2015), outlines

the possibility that non-Euclidean geometry may have allowed a platform for Victorian writers to discuss social structures and anxieties related to progress in science, especially with the introduction of Darwinism. Funk draws from Edwin Abbott's *Flatland: A Romance of Many Dimensions* (1884), which is a text that is more often paired with literary-mathematic analyses. Funk's study differs from my own in that contemplation of higher dimensions can only occur through states of dreaming and unconsciousness. I offer a mathematical methodology that attempts to illustrate an interaction between our minds and a text we are reading.

The use of mathematics with literature is currently situated in the practical use of teaching. The scholarship around pedagogy iterates that mathematics is more easily taught and more readily learned when narratives are attached to math problems. While this research has merit, it does not expound upon the important interplay between mathematics and literature either theoretically or historically. A fruitful exploration of mathematics and literature is compiled in *Circles Disturbed: The Interplay of Mathematics and Narrative* (2012). While the work collectively attempts to historicize mathematics and its influence on narrative, it ultimately falls short of effectively arguing that mathematics and narratives have a strong relationship. Perhaps the most relevant study has been undertaken by Elana Gomel in *Narrative Space and Time: Representing Impossible Topologies in Literature* (2014). Gomel's

theoretical work offers a significant amount of historicism, especially after 1900. Gomel's study argues "that representation of impossible spaces is an integral part of the narrative poetics of modernity and post-modernity" (6). Gomel successfully argues that science and humanities not only inhabit one space, but they also enrich and anticipate each other. At times, she even attributes to the humanities a better ability to communicate and perceive. Gomel describes a narrative layering presented in the work of Dickens that establishes Dickens as two separate entities, with two differing perspectives, writing the same novel and complicating the narratives of his novels. Gomel's survey is compelling, but it marginalizes the work, mathematically and literarily, prior to Einstein's theory of relativity. Gomel's discrediting of Victorian Gothic and fantasy is simplified into a rebellious spirit against Newtonian space and linear time and thought. I find this problematic because it is exactly the Victorian Gothic and fantasy, the marginalized literature that is not exactly the realist novel, that demonstrates the importance of non-Euclidean thought in literature during this geometry's infancy. A non-Euclidean perspective, especially when examining its introduction by Riemann, would suggest that marginalized literature must exist to create manifoldness.

Steampunk is a genre that can serve as the marginalized and modern equivalent and act as test to assess the validity of my own methodology: it is also a genre that is still in its academic infancy. The term "steampunk" was coined in 1987 by science fiction and horror author

K. W. Jeter. The term appeared in the April issue of *Locus*, where Jeter, in response to a review of his work *Morlock Night*, had jokingly recast the term “cyberpunk” to describe a series of works written by himself and the two other founders of steampunk. Tim Powers and James Blaylock, the two other founders, placed their narratives in Victorian London and then embedded it with anachronistic technologies and social mannerisms. The production of steampunk literature remained minimal until the turn of the century. The rise of more innovative computer technologies, as well as the internet, revived steampunk. The turn of the century marked a distinction between first-generation and second-generation steampunks. It was with the influx of new steampunks that the steampunk community fell into chaos. First-generation steampunks, who believed that steampunk was meant to be along the lines of hard science-fiction and cyberpunk, harshly criticized second generation steampunks, who suddenly took the spirit of the tinkerer and remade steampunk to their own purposes and perspectives. In terms of literature, steampunk, as it embraced fantasy and even Wild West speculative fiction, began to become only vaguely similar to what steampunk resembled in 1987. By 2005, steampunk grew from literature into a culture comprised of steampunk clothing makers, national conventions, steampunk Christmas cards, married couples actually living as though they were in a steampunked Victorian era, and the steampunk headquarters of Oamaru, New Zealand. The Oamaru community demonstrates the extremism of some steampunks, as the quarter has been

converted entirely into a functioning steampunk village. Perhaps the most astonishing development occurred around 2009 with the release of Cherie Priest's *Boneshaker*, which blended steampunk with mainstream and popular literature. Priest's novel caused a rise in steampunk literature written for young adults. After this crossover, steampunk saw both a loss in popularity and a return to steampunk similar to the 1980s steampunk literature that fell closer to cyberpunk. Therefore, in its nearly thirty-year lifespan, steampunk managed to gain a following, remake itself into a culture that caused followers to exit into popular culture, and return to its initial state of infancy.

The current scholarship for steampunk is minimal and focused on technology and the fiction's use of history to interact with modern anxieties of progress and environmental destruction. This can be best seen in the 2010 issue of *Neo-Victorian Studies*, which published a special issue entitled "Steampunk, Science, and (Neo)Victorian Technologies." Even the most recent scholarship on steampunk still examines the genre's bending of time and history to suggest a nostalgia for a technologically simpler time. The topic secondary to its historical representation is steampunk's fixations on retrofitting and tinkering with machines and objects. An entire section on this topic can be found in *Steaming into a Victorian Future: A Steampunk Anthology* (2013). The anthology provides a more expansive study of steampunk, including a few articles on femininity and the depiction of gender roles in steampunk, but the

remaining ten chapters discuss the use of history and remaking of steampunk objects. If this anthology is the best steampunk scholars have to offer, there is no doubt that steampunk has yet to gain steam in the critical arena. By contributing to this deficient field, I hope to demonstrate that steampunk literature offers more than anachronism, historical truth-bending, and turning gears. By examining the rhetoric that steampunk borrows from nineteenth-century geometry, mathematics may provide a means to recast steampunk scholarship.

Mark Hodder's novel, *The Strange Affair of Spring-Heeled Jack*, is a hallmark example of steampunk. The novel primarily follows the character of Sir Richard Francis Burton, the historical figure cast as a fictional character. The London that Burton knows transforms into a technological hub as he encounters Edward Oxford, a historian from the future who time travels to the past to stop his grandfather from an assassination plot to kill Queen Victoria. The character of Edward Oxford embodies the Victorian myth of Spring-Heeled Jack. Nearly a creation of science fiction, Spring-Heeled Jack is a man-like creature known for his metal claws, blue flames, red eyes, inhuman leaps, and attacks on working-class women. During his investigation of Oxford, Burton travels with his companion, poet Algernon Charles Swinburne. The two historical-turned-fictional characters manage to capture and kill Edward Oxford.

Unlike other literature, steampunk functions through mathematical analogies and juxtaposes them with one another. As Hodder's narrative takes motion, distortion becomes a function of the narrative. Hodder's novel highlights the innovative techniques and mathematical interplay presented in and reinforced by steampunk narratives. Steampunk is able to accomplish this interaction because of its location in the present and its ability to borrow and adapt socially, politically, and technologically relevant topics and anxieties of the Victorian era.

By utilizing two fields of research that are currently lacking in development or even content, a new path of inquiry and curiosity may open—the intersection between mathematics and literature. Through this process, my purpose is to construct a non-Euclidean reading methodology, primarily Riemannian, that demonstrates the interaction that occurs as a reader's interpretation touches the surface of a narrative. If spaces have no intrinsic geometry, then a reader must be offering and measuring a narrative space with an assumed metric. Through an examination of mathematic concepts and the application of those concepts to Hodder's steampunk novel, I argue that narratives lack intrinsic geometry. A fitting narrative description would be that narratives are flat. Through the reading and interpretation process, we give them dimension in an attempt to interpret and unflatten them. However, in all attempts at unflattening, the metric we use is undoubtedly unfit for the surface of the narrative, meaning we estimate and approximate the value of a narrative but our

measurements will also remain distorted. Hodder's novel uses the bending of history and fiction to mimic this mathematical interplay occurring in the interpretive space.

Chapter I:**Geniuses, Fools, and Shadows: Non-Euclidean Space as Our
Departure*****The Vanishing Point; or, Non-Euclidean Geometry in the 19th Century***

Prior to the middle of the 1800s, Euclidean space dominated the field of mathematics, especially in terms of geometry and dimensional space. For traditional geometers, Euclidean space could not allow for a strict visualization or mathematical description of any space higher than three dimensions; therefore, such a space was either deemed unexplorable or nonexistent. Four-dimensional space was not necessarily a new idea. Joseph-Louis Lagrange, in his 1788 publication *Mécanique Analytique*, or “Analytical Mechanics,” was one of the first mathematicians to suggest time as a primary factor in dimensional space. While Lagrange’s work focuses on the importance of time in dynamics, his work spurred, and continues to influence, applied mathematics and theoretical mechanics, two fields that are closely related to studies in physics. As Craig Fraser explains, Lagrange’s work “may be viewed as the product of a larger scientific mentality characterized by a neo-classical sense of order and, for all its intellectual vigour, a restricted consciousness of temporality” (Fraser ix).

The early 1800s, particularly in Russia, England, and Germany, saw a growing resistance to traditional views of mathematics, and geometers began to offer new views of the order of time, space, and

geometry. In 1835, Nikolai Lobachevsky, considered one of the forefathers of non-Euclidean geometry, or four-dimensional geometry, published his essay “Imaginary Geometry.” The phrase itself, aside from the mathematical ideologies it carried, understandably faced resistance. Entrenched in a mathematical tradition built on logic, order, and empiricism, a large majority of mathematicians harshly criticized a mathematical system built on what seemed to be faith and fanciful theory. Yet, Lobachevsky provided a platform for mathematics built on intuition. Considered the founder of non-Euclidean geometry, Bernhard Riemann, a German mathematician, gave a lecture, entitled “On the Hypotheses with Lie at the Bases of Geometry,” in 1854 that was published two years later.

The relative silence on the topic of four-dimensional space in the nineteen years between the publications of Lobachevsky and Riemann was not due to a lack of study, but this quiet period was more likely due to a fear of exile from the academic community. In fact, Carl Friedrich Gauss, who served as mentor to Riemann, had several accurate theories of four-dimensional space that he never published. In a biography of Gauss, Guy Waldo Dunnington asserts that Gauss feared the criticism he faced “if he were to speak out fully on so revolutionary a matter” (182). Gauss wrote in a letter to his friend and physicist Friedrich Bessel that he, in his “leisure hours,” speculates on the “foundations of geometry.” Gauss admits that “it will take a long time for [him] to bring [him]self to the point of working out and making public [his] *very extensive*

investigations,” as he “dread[s] the clamors of the Boeotian, which would be certain to arise. . .” (qtd. in Dunnington 12). János Bolyai, whose father was a friend of Gauss, was warned by Farkas Bolyai to never explore the parallel postulates.

Gauss and Bolyai demonstrate the climate surrounding non-Euclidean mathematicians in the first half of the 19th century. Even by the end of the century, non-Euclidean geometers still faced harsh criticism. James H. Hyslop, a professor and parapsychologist at Columbia University, published in the *Philosophical Review* (1896) that “the mathematician permits himself to be fooled by words, and pays no attention to their real import” (357). He thought that mathematicians were creating a half-breed of mathematics by “adding a new species [of dimensional space] and calling it by the same name as the old” (Hyslop 361). Non-Euclidean mathematics was consistently viewed as speculation and imagination until Einstein developed his own theories from them, and he explicitly praised Gauss for influencing both Riemann’s work and Einstein’s own theories.

Riemann’s 1854 lecture undoubtedly changed the secretive nature of non-Euclidean mathematics by offering an abstract and unseen mathematical system that can be understood through logical and concrete symbols. Riemann’s work also gave voice and understanding to the secret work happening between non-Euclidean mathematicians. Riemann introduced a tensor field to help define and describe curvature of space

and objects. By looking at a field tangential to a curved surface, lengths of curves can be measured, angles at a point on a curved surface can be measured, and geodesic distances on the manifold can be determined. Manifolds can be thought of, mathematically, as embedded in a surface with a tangential plane to help describe it. Riemannian geometry helps to understand the curvature and shape of space and, later, the effects of gravity—his work developed the differential geometry to inspect curved spaces in and of any dimension.

While Riemannian geometry does include vectors and scalars, the importance of Riemann's work lies in his construction of a topological space. Arkady Plotnitsky provides a comprehensive overview of Riemann's work in "Bernhard Riemann's Conceptual Mathematics and the Idea of Space" (2009). A Riemannian manifold "is a conglomerate of (local) spaces, each of which can be mapped by a (flat) Euclidean, or Cartesian, coordinate map and treated accordingly (and thus also given geometry), without allowing for a global Euclidean structure for the whole..." (Plotnitsky 108). This is how mathematicians still think of a basic manifold, and they use Riemannian geometry to understand different kinds of manifolds in various spaces. A point on a manifold consists of not only that point, but also the "neighborhood that can be treated as Euclidean, while the manifold as a whole, in general, cannot" (108). Space in non-Euclidean geometry, and when determining manifoldness, is thought of as a "conglomerate of local spaces and networks of

relationships among them” instead of “a conglomerate (set) of points” (Plotnitsky 108). Riemann’s geometry, as Plotnitsky agrees, was more “*conceptual*” than strictly applicable (107). While Riemann’s geometry is used today to measure and understand manifolds, such application later constructed the foundations of other forms of mathematics developed through the 20th century. Einstein’s theory of relativity would not have been possible without the foundations established by Riemann.

By suggesting n -dimensional manifolds, Riemann sparked the revolutionary progress of non-Euclidean geometry despite continuous skepticism from devout followers of Euclid. In 1866, Hermann von Helmholtz published “On the Factual Foundations of Geometry,” in which he unwaveringly declared the importance and relevancy of non-Euclidean geometry and attempted to improve Riemann’s work. Yet, all non-Euclidean geometers, while trying to sketch the shape of space, agreed with Riemann in that “deviation from flatness” laid the foundation of non-Euclidean geometry. Mathematically, deviation from flatness helps to describe a manifold, but it also underlies the rationale that non-Euclidean mathematicians embodied to expand geometric thinking.

Riemannian geometry is indeed important in understanding modern fields of mathematics and physics, but what many non-Euclidean geometers in the 19th century seemed to focus on was movement and the possibility of another world that has a mathematical relation, either congruent or parallel, to the world we inhabit. Deviating from flatness,

along with determining angles or length embedded in manifolds and geodesic lines in Riemannian geometry, suggests movement in a specified direction—deviation defined by departure. William Kingdom Clifford explicitly addresses movement within four-dimensional space in 1873. In “Postulates of Science and Space,” Clifford argues that if you walk in a straight line, “you would arrive at this place,” or the starting point. If this traveler has returned to the beginning, Clifford asserts, then only two scenarios are possible:

One of two things would be true. Either, when you had got half-way on your journey, you came to a place that is opposite to this, and which you must have gone through, whatever direction you started in; or else all paths you could have taken diverge entirely from each other till they meet again at this place.

(86)

Clifford’s reasoning signifies movement and direction, and it also hints at a different reality that other mathematicians, like Helmholtz, were exploring. Helmholtz describes the world as it appears in a common garden globe. Every shape and line in the world we inhabit would have its equal within the garden globe, although the “images are diminished and flattened in proportion to the distance of their objects from the mirror. . .” (315-6).

In 2003, the Gairloch Gardens in Ontario, Canada, featured an outdoor installation by Oakville Galleries, entitled “A Conversation of

Views,” that offered a visual execution of a distorted, curved mirror. The installation utilized two gazing globes and a viewing frame with a table. Nyla Matuk notes that the “large anti-perspectival Victorian Gazing Globe” (see fig. 1) highlights “distortion and clarity.” The globes mark a “playful existential crises” as the viewer traverses the “dialogic boundaries and self-other delineation.” While ““dialogue begins across the interior space between the objects,”” the globe ““concentrates the sitters in [a] collision of views”” (qtd. in Matuk). In looking in the sphere, we can see that while each object facing the globe has a reflection, the curvature of the reflective surface distorts an object depending on the object’s distance from the globe. The trees closest to the globe are severely shrunk and bent, and the trunks no longer appear vertical. The objects further from the mirror, while they do not appear as extremely stretched or bent, appear smaller and shrunken. The vanishing point decreases in the gazing globe.

I mention Helmholtz, Clifford, and Riemann not just because they were significant in the development of non-Euclidean geometry, but also because their specific language can be used to understand how literature passes through time and space, as well as literature’s relation to readers and scholars. Specifically, I want to focus on key words or phrases embedded in these geometers’ vocabulary that appear in this particular, historical moment of mathematics. I first want to focus on “distortion” as it results from movement in a particular direction and through space.



Figure 1

Source: PLANT, "A Conversation of Views," *BranchPlant*,

<http://www.branchplant.com/design/oakville-f.html>.

Distortion and direction inevitably lead to the idea of opposites. We tend to think of books linearly. We think of books from cover to cover. We number the pages from their beginning to their end. We imagine narratives

from start to finish. Even if a narrative includes flashbacks, we situate those flashbacks in either the narrative structure or a temporal understanding of how time in a novel unfolds: this practice is especially prevalent and used for detective fiction and multi-perspective narratives. Such a linear organization of narrative is comparable to a perfectly flat mirror, which reflects an inverse image that, to a degree, retains the features and structure of the image it is mirroring. I do not propose that this linear way of thinking about narrative is without use or validity. In fact, my mathematic argument would deem that linear structures of narrative must exist. Despite its usefulness, I find the Euclidean treatment of narrative to be the result of narrow-minded reading that ignores the slow change in a narrative's shape as it becomes further embedded in time.

Instead of reading linearly, we must find and read the curvature of a text in order to find its embeddedness. The mirror helps us to first realize that a self exists beyond us, and our inverse being suggests that he/she is different than us but not unlike us. Recognizing the existence of a mirrored self recognizes that a curvature also exists. We can then read and calculate ourselves and our text along this curvature. By moving along this surface, we will inevitably see the distortion of ourselves and our text. The movement allows us to see the result.

Matuk points out this feature and argues that "you are, in the midst of these variegated elements, as questioning of your own view as you are

of the view of yourself offered back through the globe” (Matuk). Her analysis aligns with the non-Euclidean view of this mirror effect, but geometers carry the idea to the perspective of the mirrored self. The mirrored self is confined to the limitations and perceptions of its own reality, unable to see into ours. If we were able to converse with our mirrored self, “neither, so far as I can see, would be able to convince the other that he had the true, the other the distorted relations” (Helmholtz 316). The analogies created by geometers like Helmholtz helped to visualize how a higher dimension might look or function, but such analogies simultaneously fed into criticism from Euclidean geometers that non-Euclidean space was not a real math because the space it described could never be concretely seen. The work and views of Aristotle and Ptolemy held true to Euclid, especially Euclid’s Fifth Postulate of parallels, the postulate on which Riemann’s work pivots. In the Ontario garden, Matuk remarks that “if you stand in front of [the garden globe] and move a bit, it seems that the whole reflected image moves with you,” and “when the whole landscape moves too, your view of yourself can appear as shaky as anyone else’s” (Matuk). Movement concurrently creates distortion and allows us to see it.

Distortion suggests dimension and giving dimension to a text along curvature indicates flatness. The phrase “flattened,” or flattening, in its mathematical sense can help understand what I will explain as the flattening of literary texts, specifically through accumulation of data. I will

use non-Euclidean geometry, and some of the science developed from it, in the same fashion that mathematicians and scientists used it, even Einstein, before Einstein's theory of relativity—*conceptually*. By remaining conceptual, I hope to retain the same spirit of Helmholtz in “The Origins and Meaning of Geometrical Axioms” (1870) and explain myself in a way that is “plain even to those who are not mathematicians” (53).

Four-dimensional space, or four-dimensional geometry, served several functions in the 19th century. First, and foremost, non-Euclidean geometry created an opening in the space of geometry to explore mathematics that rests on imagination, intuition, and creativity. Riemann effectively removed the shackles of logical, Euclidean perceptions of space from the ankles of ordered minds. This is not to say that the mathematics of non-Euclidean geometers was unfounded; in fact, these geometers were required to be as logical and ordered, if not more so, in their theories than their counterparts. Four-dimensional geometry served as a conceptual tool in mathematics to contemplate possible explorations in and applications of geometry, algebra, and physics, and it also opened new territories of thought in psychology and philosophy.

Looking at the history of mathematics, the importance of this geometry is seen in the application of Riemannian geometry, as well as its influence on accepted and modern theories and modern branches of math and science, including string theory. When carrying the examination of

four-dimensional space into the literary field, the importance of Riemann and his contemporaries is virtually non-existent. In fact, after understanding the importance of non-Euclidean geometry, to think, particularly, of 19th-century England without considering the mathematics of the time is shocking. In tracing the key features of four-dimensionalism from the Victorian era to modern literature and bodies of text, especially science fiction novels and film, we can understand how non-Euclidean space allows us to rethink the relationship of literature to the world in which it exists.

Reading Continuous Motion and Talking Curvature

Movement proves to be especially important, numerically and conceptually, to non-Euclidean mathematics. To calculate the geodesic of a curved space or, more importantly, of curved space-time, a mathematician must calculate or anticipate movement and acceleration in a particular direction. Einstein refined mathematics to allow for these calculations, but movement remains important to non-Euclidean geometers, even if they were not quite sure how to understand it or use it in further calculations. In fact, 19th-century geometers had speculations on how movement worked in four-dimensional space, as well as between a third and fourth dimension.

Geometers, like Helmholtz, had a difficult time separating the idea of movement and a world existing beyond three-dimensional reality: I will

address both through the work of Gustav Fechner. As a philosopher, psychophysicist, and physicist, Fechner's essays, "The Shadow is Alive" (1846) and "Space has Four Dimensions" (1846), unsurprisingly question our perceptions of reality and our effects on the world around us if four dimensions do indeed exist. In terms of movement, Fechner describes a "back and forth" motion through space. He also uses this motion to describe the movement of time.

Movement makes sense, as topology is concerned with the change, if any, of shapes and geometric properties when undergoing deformation. The Mobius strip of 1827 is part of four-dimensional history, providing an idea of how objects can move in four-dimensional space. As the Mobius strip illustrates, and as Riemannian geometry supports, a three-dimensional reflection through a plane signifies a four-dimensional rotation through a matrix. The Necker cube serves as a simplified example (see fig. 2). When looking at the Necker cube, the "front" of the cube, or the face of the cube that juts out towards the viewer, continuously changes. In Figure 1, the face of the cube that is shaded yellow (white in monochrome print), at certain points, juts out towards the viewer and serves as its "front." At other times, the yellow face is furthest away from the viewer, seen through three transparent faces.

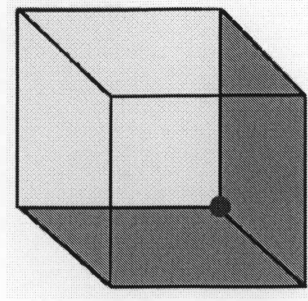


Figure 2

By seeing the sudden changes of face, we can visualize Fechner's "back and forth" motion of nature. Geometrically, as the face changes, we see that the cube stays the same: the cube's size, shape, and color have not changed. Visually we see one face of the cube, and then we see the cube inverted. For this reflection to happen, rotation in a fourth dimension, one that we cannot see, must occur. Our minds and eyes see the result of movement, in this case rotation, in and through the fourth dimension.

Fechner described what his eyes saw—a "back and forth" motion. Helmholtz's mirror worlds and Clifford's opposite world are understandable in this light. Helmholtz's mirror man would not believe himself to be a distortion, and Clifford's opposite world "may be the true state of things" (Clifford 86). The movement presented by these geometries, and represented here by the Necker cube, will allow us to better understand how to read Mark Hodder's work, and it will help us understand *how* we interact with literature. When thinking of narrative structure, the simple illustration of a narrative arc, which we teach schoolchildren, comes to mind. My intention is not to argue that a narrative arc would be a natural reflection of our dimensional world, nor

do I want to argue that narrative arcs are the only form of basic narrative structures. Instead, I want to examine narratives as if holding them up to the garden globe in Gairlock Gardens. In doing so, the narratives reveal distortion that is inherently present but can only be located through the curvature of space, which can only be identified through non-Euclidean mathematics. If we read along the natural curvature that constructs our world and look through it to the image reflected back, we find ourselves and our texts to be undeniably flat and distorted.

Hodder's novel serves as a primer in reading in a non-Euclidean manner because it explicitly marks the distortions, movement, and flattening for us. *The Strange Affair of Spring-Heeled Jack* acts as a non-Euclidean reader to demonstrate to us, its companion, *how* and *when* it needs to take notice of motion, mirroring, and distortion. The narrative accomplishes this through its historical, temporal, and narrative manipulation. The curvatures of the narrative and the characters are exaggerated and accentuated to specifically train us in acknowledging a distorted reflection of our world and the world represented within the novel. Therefore, Hodder's novel, without subtlety, stretches and distorts Victorian culture, contemporary culture, history, and time to create a single narrative and image that reflects the accumulation of sectors from which it takes and sifts.

In "Space has Four Dimensions," Fechner's motion can be perceived as regression, or retrogression. Regression is often perceived

socially as a negative term, an idea that does not necessarily hold true in mathematics. Regression could be used, in statistics for example, to describe the relationships between and among different kinds of variables. Fechner, in fact, uses four-dimensional geometry to suggest a more complex interchange of information that occurs through motion. He provides a piece of paper disrupting two rays of colored lights as his example. As the paper changes location, the distance between the beams of light shown by the intersecting paper changes. The change in the angle of the beam hitting the paper after its movement causes the difference, not exclusively the motion or placement of the paper: "In the same way, when something seems to move in our three dimensions, it is only because the beam that extends into four-dimensional space is directed obliquely against the three-dimensional surface, and as the surface moves, it cuts the beam at different places" (Fechner 135). To simplify, time and space exist like a book. The pages compile single moments in a narrative confined by the book's physical shape, and the narrative remains confined by our time. We can easily open the book and rip out a page. This page is only a small cross-section of the overarching narrative, and this page represents a cross-section of our time. However, the single page suggests features, themes, and structures that may be found within the book.

The experiment offers two very important notions about time and space in four dimensions: the first is that the severity of the angle determines the speed of motion observed, as well as the cross-section of

features we perceive. Eight years prior to Riemann's essay, Fechner's "The Shadow is Alive" (1846) uses what he meant as a satirical analogy to explain the dimensional limitations faced by geometers, but this analogy also serves to understand how the location of a viewer in any dimensional space effects how the viewer perceives motion and objects in higher or lower dimensions. Just as the title suggests, Fechner describes a living shadow, a two-dimensional creature, created and cast from its three-dimensional counterpart. Fechner's shadow man proves interesting in that his two-dimensional existence is independent of and dependent upon his three-dimensional complement. Reality, to an individual, entirely "depends on the point of view" (Fechner 131). In the eyes of the shadow man, his three-dimensional counterpart "is an imaginary being entirely dependent" upon the existence of his two-dimensional self: the three-dimensional is a "crude imitation" of the two-dimensional being.

The most important aspect of Fechner's essays is the idea of the "back and forth" motion and the relationship between a shadow and his man, which illustrates a balance of power. The shadow, if he were to respond to his three-dimensional man, would argue in "equivalent arguments" (Fechner 130). The shadow must retain equivalency, in its own dimension, to the man who casts him: "Neither a genius nor a fool can behave differently than his shadow" (130). For Fechner, and for four-dimensional geometers, the equivalency is not necessary parallelism, which why geometers find mirrors to be the most accurate analogy to use.

To cast a shadow, a light must be present in a higher-dimension: “our body must provide residence and nourishment for one spirit (the soul) and give light to another (the shadow) – to be sure, not positively but negatively, that is, to supply the necessary absence of light” (Fechner 131). What Fechner inspired in the later work of Helmholtz and Riemann is the notion that those in different dimensions must be “the reverse of our positive being,” and they are therefore irrevocably linked to us and positioned in reference to our existence (130). Fechner describes himself as a positive being, as he naturally places his own perspective as positive and central, similar to Helmholtz’s mirror men believing themselves to have the correct perspective. Helmholtz’s language and analogy prove similar to Fechner, who believes “Just as man may say that he doesn’t believe in the life of his shadow, with equally good reasons the shadow can reply that he doesn’t believe in the life of his man” (130).

Due to dimensional limitations and how those limitations alter perspective, Fechner’s dimensional creatures are distinct from, but entirely dependent upon, each other: “A positive being is inconceivable without the contrast provided by a negative being: it owes its illusory existence to its antithesis” (131). Fechner’s four-dimensional space is founded in the idea of a balance created through reverse imaging, antithesis, or equal opposition. If reading along with and interpreting through curvature, the image or interpretation presented to us both reflects and does not reflect our society or the society represented through the narrative. In non-

Euclidean space, the moment an object is reflected in space it becomes distorted. Such is true even for the flattest of mirrors, as all objects are inversed in mirror. If a book is placed closely to the surface of a gazing globe, like the trees in Figure 1, its image in the mirror will elongate and stretch around the globe. While the image changes, the book in hand remains rigid and three-dimensional. If the book is moved away from the gazing globe, it flattens until it vanishes from view completely. Literature, narratives, and texts work similarly. The closer a narrative comes to reflection and temporality, the more it becomes distorted. The further it recedes, the flatter and less visible it becomes.

To better understand how four-dimensional space serves as a cipher to these interactions between an object and its distorted reflection, I want to return to Arkady Plotnitsky's article. Plotnitsky described Riemann's manifolds as a sort of map, showcasing interconnected neighborhoods. Curvature serves as the lens, or intermediary, between the narrative of three-dimensions and the narrative of four-dimensions. Reading along the curvature allows us to find the connections between the texts represented on both sides of the curved surface, or of curved space. Understanding how to read and see distortion is important because it forces us as readers and scholars to see how the processes of reading and interpretation are more complicated and manipulative when texts are not simply accepted in linearity. Instead, these processes demonstrate a necessary need to filter through layers of data accumulation, or lenses, that

contribute to the flattening and distorting of texts and narratives. Reading *along* a curvature demands us to recognize a reflected text and sift through layers of distortion to help unflatten the text and understand the distortion perceived. By taking distortion into consideration, reading *through* curvature aids in the interpretation of the overall image being reflected. Distortion and movement indicate dimension, and reading along and through curvature creates a space for narratives to inhabit several dimensions at once. In a sense, the curvature, taken from non-Euclidean mathematics, helps to demonstrate their embeddedness—their interconnectivity with the worlds they reflect currently and try to reflect retrospectively.

Chapter II:

Blinking Realities: Stacking Data to Flatten Bodies

Flattening Narratives

I suggest that *flattening* is the intentional and unintentional smoothing of narrative, or its characters. The flattening process occurs when we work as accomplices to a narrative that smooths or uncomplicates its narrative's structure(s) and character(s). The process occurs naturally through the build of data atop and surrounding a narrative, as the weight of information tempers the object to which it describes. The flattening process effectively gives characters' *flatness*, which then offers us the ability to give dimension to characters and approximate their embeddedness in their respective narrative and our respective identified society. Therefore, flatness of character or narrative is not similar to a more typified idea of flat and round, especially when referring to E. M. Forster. Instead of determining characters to be round or flat by the multitude of the "factor[s] in them" (Forster 103), the inherent flatness of characters allows us, as readers, to give them dimensionality. This dimensionality offers more understanding in our own cultural thought than of the narrative's historical moment.

Steampunk proves useful to explain flattening because its use of cognitive estrangement, a popular feature of science fiction, pivots on historical moments and settings that existed, and yet they are made to be moments that simultaneously cannot and do not exist. The genre attempts

to reflect a contemporary moment through a non-existent historical one that is like and not like a historical past and a current present. Steampunk's obvious manipulation of history and narrative explicitly demonstrates how stacks of information inherently flatten narratives and characters. Mark Hodder's *The Strange Affair of Spring-Heeled Jack* (2010) will serve as the primer in understanding manifoldness and flattening because it serves as a categorically steampunk novel.

Hodder's narrative houses characters and settings that are flat and flattened, but it does so in order to highlight our powers, as readers, as well as steampunk as a genre, to inflate the narrative and give its characters and settings dimension. Steampunk's ability to suggest dimensionality through already-established interconnected neighborhoods of information underscores the flattening process built into narrative structures. The power of unflattening primarily rests with our ability to connect and interconnect neighborhoods of data. To understand how dimensionality is established, flatness must first be identified, and Hodder's novel, through its utilization of features intrinsic to the steampunk genre, exaggerates flatness of characters to help us calculate the narrative's manifoldness.

The Strange Affair of Spring-Heeled Jack is split into two distinct narratives that illustrate two perspectives of the same story. The first half of the narrative takes place in 1861 and follows Sir Richard Francis Burton, who leaves his career as an explorer to become a special agent for

queen and country. A strange time traveler assaults him, and in this manner Burton's first case quite literally appears before him. Burton teams with poet Charles Swinburne to capture and effectively stop the assaults undertaken by the mysterious time traveler that the Victorians nickname Spring-heeled Jack. As the narrative progresses, Victorian London changes into a technological scene that houses motorized hovercrafts (roto-chairs), motorized land vehicles (velocipedes), genetically bred greyhound dogs used to deliver letters, and genetically engineered parrots that verbally deliver telegrams.

The second half of the novel follows the perspective of Edward Oxford, the time traveler. Oxford creates time travel technology for the sole purpose of traveling back in time to stop his ancestor from attempting to assassinate Queen Victoria. In the process, Oxford causes his ancestor to successfully murder Victoria. For the remainder of the novel, Oxford attempts to stop himself from intervening with history while simultaneously trying to evade capture by Burton and the authorities. As Oxford's repeated attempts to stop himself in time fail, he psychologically deteriorates and decides to rape his ancestor's wife, believing the rape will force himself back into existence. The narrative of Oxford, through his perspective, demonstrates a psychological unraveling and temporal unbecoming.

The mingling and bending of time, history, and narrative in Hodder's novel, and in steampunk, cause distortion, yet Hodder's

narrative depiction of geometric mingling and juxtaposition with its historical manipulation suggests, for his specific work, an overlay and interaction between 21st-century ideas and 19th-century history and culture. To avoid confusion, I pinpoint the ideas to the 21st century because of the novel's publication date. While the character travels from the 23rd century to the 19th century, the publication of the novel helps us to pinpoint a society which it may be trying to reflect. I set this limitation not for simplicity but because steampunk strictly mirrors the contemporary society in which it works. Aside from the obvious point of Edward John Oxford, the time traveler, jumping to the 19th century, the way in which Oxford technologically prepares himself to exist within and read Victorian London suggests narrative and interpretive overlay. Oxford understands that if he simply jumped in time to the 1800s, he would risk severe "culture shock" (Hodder 245). To avoid this, Oxford integrates "in his suit a system whereby Victorian reality would be, from his perspective, overlaid with his own twenty-second-century reality" (Hodder 244). With this technology, "His helmet would alter the way his brain interpreted sensory data, so that when he looked at a hansom cab, he would see and hear a modern taxi; when he observed Victorian people, he would see citizens of his own time, and towering over the skyline of 1840, he would see the skyscrapers" of his own London (244). Oxford then puts "mock Victorian clothing" under his time suit, so that he blends into Victorian society when he removes his technological suit (245). Oxford's

technological outfitting, and his mock costuming, is a working example of data overlay and intermingling.

The overlay of Oxford's contemporary landscape onto the 19th-century setting does not replace Victorian London, nor does it make Victorian London more able to be perceived. Instead, the "overlaid" reality makes portions of Victorian London more comprehensible to the out-of-century reader, Oxford. The technology suggests that the overlay *must* occur because it allows Oxford to comprehend, in part, the moment in which he should not and cannot exist. The overlay allows him to comprehend the moments, historical and temporal, that cannot be read otherwise. His lens gives breadth to the impossible, incomprehensible moment. The narrator even bolsters the necessity of the overlay by offering the deterioration of Oxford's corporeal and temporal body, as well as his mind: "Edward Oxford was disintegrating. Submerged in a world that was alien to him, and with the knowledge that his own time no longer existed, he was disengaging from reality. Psychological bonds had loosened and slipped free; he was floating without coordinates. He was losing his mind" (271). Before Oxford jumps in time, he tries to avoid suit malfunctions by connecting his technology to gravitational points considered constant. He describes the fixation as "tethering" (244). While Oxford contends that it stops him from materializing in solid objects, the technology psychologically connects and tethers him to his own time. The overlay ties his mind to the 23rd century, and the malfunction of his suit

simultaneously loosens him from his own time and immerses him in a historical moment that he cannot comprehend without reference.

With Oxford's technology in mind, I suggest that we experience literature through an accumulation of historical, personal, and literary data: the layering of this data, which inherently flattens bodies of text through time, creates points of contact where distortion intrinsically alters our perception of these bodies as we attempt to give them dimension and make them comprehensible. A good representation of this would be the now outdated use of transparencies. If a transparency sheet with a drawing on it represented a single year of time and another transparency is placed on top, the image on the bottom is sure to be slightly obscured. The bottom image is now fixated under the weight of other layers of data. In Oxford's case, his helmet overlays the data so that his 23rd-century brain is not overwhelmed, but his brain still must perform interpretation. The significance is directed to the manner in which interpretation occurs, because as Oxford's helmet begins to overlay the data, "Information began to pass back and forth between his brain and the helmet's powerful processor" (245). The interpretation of data is no longer between Oxford and the physical world he inhabits. Instead, the interpretation process becomes a conversation between a flattened version of reality, created through Oxford's helmet, and Oxford's brain. The processor stacks information, effectively flattening it, in order to help the brain process. The brain becomes the power that gives dimension to the flattened reality.

The interpretation process through these flattened means becomes problematic in its power of distortion, which I will discuss later, but the flattening process needs to be apparent to see this distortion of interpretation.

I offer two approaches, mathematically, when handling the idea of flatness and flattening. The first means is vectorization, which is an algebraic method of visually demonstrating flattening. From the transformation process illustrated by vectorization, I move into Riemannian space manifolds. The transition from algebra to geometry helps to grasp the concept of how flatness created by the linearity of narratives translates to the dimensionality that Riemannian geometry strives to describe. The goal is to demonstrate that Euclidean narrative attempts to flatten and smooth time, space, and character to make a narrative more easily discernable to us. I initially set my limitations to the confines of the narrative, just as any mathematician would set limitations for her own formulae and computations, so that I can simplify complex problems practically, apply found behaviors and patterns to a larger set of inputs or data sets, and strive for continuity. Hodder's novel serves for my purpose because it offers two levels of inspection that function in the mathematical methodology I ascribe to reading and literary analysis. The novel initially operates within the confines of itself, and, in doing so, flattens its characters and settings to specifically outline its own manifoldness. The novel then works outside of its narrative borders to

allow for a determination of its manifoldness as a narrative working among other narratives. To understand its second function, we must first understand how and why it flattens its own characters and settings.

Flattening through stacking can be shown visually, in mathematics, through vectorization in matrix theory. I find it appropriate to use matrix theory not only because its branch in physics harkens back to non-Euclidean geometry to develop later string and superstring theories, but the way it is visually represented demonstrates the compressing and flattening power of combined and accumulated data. When one matrix is vectorized, or flattened, the information in the matrix stacks linearly to create a single, aligned column of data. For example, a 3x3 matrix would be represented by three columns with three rows (Fig. 3). When the matrix undergoes flattening, or vectorization, the matrix that appears after the invisible flattening process is represented with one column [Fig. 4]. The two figures demonstrate visually and mathematically how the stacking of information flattens the original text.

$$A = \begin{array}{|c|c|c|} \hline a & b & c \\ \hline d & e & f \\ \hline g & h & i \\ \hline \end{array}$$

Figure 3

$$\mathit{vec}(A) = \begin{array}{|c|} \hline a \\ \hline d \\ \hline g \\ \hline b \\ \hline e \\ \hline h \\ \hline c \\ \hline f \\ \hline i \\ \hline \end{array}$$

Figure 4

To reiterate the principles of movement and balance, the matrix depicted underwent an invisible change and movement that we cannot see. Instead, we see the result of the vectorization process (as shown in fig. 3) just as we see the result of the Necker cube rotating in space (see Fig. 1). While the process did flatten the matrix, the matrix and the vector column retain balance, just as the Victorian gazing globe retains balance with the world surrounding it. The data contained within the 3x3 matrix did not change, but it was mathematically flattened.

The narrative of Hodder's novel mimics, at times, the vectorization process, particularly when unraveling the existence of Edward Oxford, by stacking lines of narrative into a vector column. The narrative stacking results in the flattening of the characters, the narrative, and our understanding of both. The narrative vectorization appears more frequently when the narrative shifts to Edward Oxford's perspective, especially when he redirects history or jumps through time. Just as we cannot see the rotation of the cube or the movement in the vectorization process, we cannot see Oxford's movement through time in our narrative equivalent. Instead, we see the *result* of Oxford's movement through time. The moments in which Oxford jumps in time are striking when compared to the rest of the narrative. Structurally, the time jumps are categorized by short sentences and fragments that create a temporary and jarring shift in the language, as seen when Oxford jumps between two points in the Victorian era:

Reality blinked

He fell and landed on flat ground beside a tree.

It was night.

It was not his garden. (257)

In this instance, Oxford jumps from 1837 to 1877, although he intended to jump forward to 2202. The act of blinking, used here to mimic the act of jumping through time and space, matches the language, as the short lines act as blinks of language. The same blinks of language appear when Oxford inevitably changes the course of history. Oxford cannot specifically identify his ancestor, but he can identify her by a birthmark genetically passed to her grandchildren. Oxford is able to narrow down the servants in London to a pool of possible ancestors. He then systematically assaults them to identify the correct woman he intends to rape. One is Deborah Goodkind, who, like Oxford, has a family history of madness:

She raised her right hand and banged the heel of it against her ear.

She did it again.

And again.

And again.

And she started to giggle.

And she didn't stop.

Not until the year 1849, when she died in Bedlam. (291)

Figures 2 and 3 demonstrate stacking as a way to mathematically flatten information, and Oxford's technology stacks information to flatten the

Victorian reality Oxford jumps into in order to make the reality more understandable to a mind temporally distant from it. Meaning, Oxford's futuristic technology uses futuristic images to make the past he visits more understandable to his time traveling body and mind.

The vectorization example, aside from illustrating the process of undergoing flattening, suggests the *treatment* of elements, or data. Vectorization is primarily a flattening process because of its efficiency in time and calculation. In $\text{vec}(\mathbf{A})$ (see fig. 4), calculations or operations are applied simultaneously to every element, or variable in this case, in the column vector. The matrix works differently in that calculations or operations can be applied to groups of data instead of every element simultaneously. In fields like computing and programming, vectorization means that operations that continuously function in loops apply applications to all elements simultaneously, causing the machine to work faster and perform more loop applications in an equal amount of time.

If the vectorization offers a manner to treat data, Deborah Goodkind's disturbing stack of data can be read through the vectorization process to better understand flattening as we process the narrative's data stacks. The moment Goodkind bangs herself in the head, we question the mental stability of the character. The next line of data, in which "she did it again," reassures our assumption, eliminating any hint of question. The remaining lines, the remaining data in the narrative column vector, are quickly scanned and the same operations are applied to them. Reading the

stack of data, the eye naturally moves more quickly and efficiently through the words, already knowing what the data indicates—Goodkind must be a madwoman. The repeated “And” and “She,” along with the repeated /g/, cause us to naturally move more quickly through the words, sounds, and sentences. After we understand that Goodkind is mad, the information provided in the remaining lines no longer becomes important because that notion of her character is applied to each line, or each line of data, simultaneously.

Undeniably, the stacking of narrative describing Goodkind’s psychological state of mind is effective and eerily outlines her mental instability. I am not arguing that repetition is effective in outlining her psychology, but the stacking in this instance renders her flat: it even flattens her to a point of death. Goodkind is vectorized so that we can quickly and efficiently read and discover her featured characteristic, and her *only* characteristic. This stacking reduces Goodkind into a madwoman *and* a dead woman. Therefore, she has no room to be given dimension outside of the confines of the small stack of narrative she is given in the novel.

The same treatment works with Oxford’s time jump to 1877, and the information can even be used in the matrix. If the lines were placed in a matrix, the information would have to be processed in groups (see fig. 5). In the matrix of Oxford, the lines of the narrative, now replacing the variables, create data sets that are visibly large. Mathematically, either the

four lines would create separate columns in the matrix, constructing a 1x4 matrix, or the data would be symmetrically grouped, creating a 2x2 matrix that I have chosen to construct. If the matrix were to undergo calculations, the matrix demands a specific order of operations.

<i>Oxford =</i>		
	<i>Reality blinked</i>	<i>It was night</i>
	<i>He fell and landed on flat ground by a tree</i>	<i>It was not his garden</i>

Figure 5

The data composing the left side of the matrix would undergo operation or treatment first. This means we look at these two lines simultaneously and group them together. Therefore, we would read that reality blinking and Oxford falling work hand in hand. Even in this operation, the action happening between the two lines is invisible to us. We assume that Oxford traveled in time because we see the result that follows the first line of data. We process the two lines simultaneously and attribute the falling action to the time travel that occurred after the blinking realities. We would then leave the left side and perform a calculation or treatment to the right side of the matrix. The two lines would be grouped and treated simultaneously, without considering the left side for this operation. This means the fact that it “was night” and the fact that “it was not his garden” go hand in hand to create one image, or one understanding.

$$\text{vec}(\text{Oxford}) = \begin{bmatrix} \text{Reality Blinked} \\ \text{He fell and landed on flat ground by a tree} \\ \text{It was night} \\ \text{It was not his garden} \end{bmatrix}$$

Figure 6

The narrative, instead, presents the information as if it had undergone vectorization (as depicted in fig. 6). Unlike the matrix, the data set in the column vector undergoes treatment simultaneously. At the same time reality blinks, Oxford falls, it is night, and we see it is not Oxford's garden. The realities blink simultaneously, meaning they all occur at the same moment. The matrix and vector column offer two modes of understanding. The left column of the matrix is a data set of actions, whereas the right column is a data set that includes conditions of being that contribute to understanding. The left side describes *what happens*, while the right side describes *what that means* to the character and the narrative. Through vectorization, these two separate acts are lost. Instead, the vector column offers a variety of actions. We could concurrently read the action and understand the state of being. However, the simultaneity seems to lose the state of being attributed to the right column of the matrix. Upon reading the phrase "reality blinked," each line, in a singular moment, becomes a fluttering actuality that is temporally and intuitively as fleeting as Oxford's stay in the year 1877. To think of Oxford's helmet, the blinking reality is laid atop the conditions of being. Now we must communicate with the overlaid image that has been processed through other means instead of interpreting reality directly. Not only does the

narrative begin to flatten, but our understanding also flattens. By stacking the narrative, we lose a sense of environment and temporality in the narrative and the setting. We lose the power to interpret because as we begin to interpret one image another image is stacked atop it. As reality blinks for Oxford, our understanding of his reality and his narrative flickers.

Perhaps Hodder's own phrase, "reality blinked," can serve as another way of understanding how the data stacked in the narrative flattens its characters and its own narrative. In geometry, the term "flat" in two-dimensional space generally refers to points or lines, while flat in three-dimensional space refers to points, planes, and lines. The term "flatness" differs from flat in that "flatness" helps describe the degree in which a surface estimates, or approximates, a plane. This means, in Riemannian geometry, "flatness" describes and defines the characteristics, including smoothness, of a manifold that resembles Euclidean spaces that may be unsmooth. In returning to Oxford in 1877, the three layers of data act like blinks, causing a new reality to appear before us, a process that we do not actively see. Instead, we see the result of the process. In the first instance, we blink and see Oxford next to a tree. We blink again and see that it is nighttime. We blink a third time and see nothing new, but we understand that Oxford is not home. Just like Oxford's overlay technology, new realities are laid atop the old. None of the realities, or layers, are given more consideration than the others as to which reality is

real or more significant. The layered realities flatten and obscure the image of Oxford next to a tree by muddling it with more information that does not replace it. To return to Fechner's experiment, we see the beams "directed obliquely against the three-dimensional surface" (Fechner 135). Mathematically, blinks of information, blinks of reality, and blinks of language show inherently flat and fragmented pieces of a dimensional whole.

The narrative even reduces itself, expecting us to fill in gaps of understanding and motion between stacked lines of data. Henry de La Poer Beresford, 3rd Marquess of Waterford, convinces Oxford to rape his ancestor or find another way of stopping the assassination aside from direct intervention with himself. Aside from the grandfather paradox already created, direct intervention, which Oxford already attempted, would create another causal loop paradox. The decision means that Victoria is assassinated and the murder of Oxford's ancestor occurs. The passing of this moment offers four lines of narrative data:

January, February, March, April, May, June passed.

July came.

Queen Victoria was shot dead.

Her assassin died a few moments later. (281)

The vectorized narrative column carries the simultaneous passing of time and the death of two characters. The reduction of narrative only bears weight by the invisible force of narrative that occurs before this column.

These lines mean nothing without knowing the actions that occur between the temporal markings and the conditions of the two dead characters.

Essentially, we must insert information and assumptions between the lines in order to understand what this stack of narrative is telling us. If we read in between the lines, we understand that Oxford appeared from the future and failed to stop himself. The narrative manages to reduce itself within four lines of data. The implications between the lines represents the nearly three hundred pages of narrative that allow for the invisible motions happening between each line. The narrative manages to reduce itself and smooth its own narrative arch to fit between four lines of data.

By overlaying their own language and structure with stacks of new information, narratives work to smooth realities by overlaying them and making them Euclidean and linear—by making them *comprehensive* and *comprehensible*. The characters are reduced and flattened either through non-dimensional development or by the linearity of life that leads to death and conclusions. Oxford dies by the conclusion of the novel, as does Deborah Goodkind. Aside from Sir Francis Burton, and possibly Charles Swinburne, the characters of Hodder's novel are throwaway caricatures and mechanisms of plot progression. In fact, the opening of the novel is premised on the near, and later, death of John Hanning Speke, explorer and rival to Burton. John Speke is reduced to nothingness in the first line of the novel: ““By God! He's killed himself!”” (Hodder 13). Isabel Arundell, initially Burton's fiancée, is treated similarly. She appears at the

opening of the novel, and after her engagement is broken, she only appears at the end of the novel through a letter describing her plan to travel to Arabia. Seemingly, all characters exist to merely substantiate Sir Francis Burton as the main character of the novel.

To return to Riemannian geometry, flatness is read by determining the curvature of the manifold in space. According to Leonard Charlap, “we say a Riemannian manifold is flat if its curvature vanishes at each point” (15). “Each point” refers to chosen reference points that allow for measurement. Returning to Goodkind’s data column, we can view the first line of the column as a point to begin calculation, and the final line, noting her death, can be used as the end point of curvature calculation. If we read Goodkind’s character, from beginning to end, her characterization remains flat. She does not develop beyond madness, nor can she develop beyond her own death. Charlap notes that “a manifold is said to be *flat* if its curvature vanishes everywhere” (16). Goodkind’s character is nothing but flat. We see the same flatness in the novel with the treatment of Isabel Arudell, John Hanning Speke, Charles Darwin, Isambard Brunel, and, to some extent, Edward Oxford (Spring-heeled Jack). The specific curvature that can be associated with each individual character reads as flat along the narrative, causing the curvature to inevitably vanish at the beginning and ending points used to measure them. This notion of flatness between points can be envisioned by imagining an expansive plain or prairie. If you were to stand at one point on a plain and look outwards, the land between

you and any point would look undeniably flat, contradicting the curvature of the spherical planet on which you stand. The novel works similarly in that the landscape of its *characters* look tellingly flat. When localized, these characters are perceived as flat; yet, such flatness serves a broader purpose, since their flatness assists in understanding how they fit and function on a broader scale of interconnectivity. Their flatness, despite how counterintuitive it may seem, contributes to the overall manifoldness of the narrative, and they must be flat so that we may later provide dimension to them.

I have only determined the flatness of the characters within the confines of the narrative, but Oxford's overlay technology further expands the flattening of characters to the flattening of London by considering the overlay of the science fiction narrative onto the historical setting. Instead of a helmet processor overlaying the images of 2202 on Victorian London, the narrative of the novel overlays contemporary images onto the setting, such as futuristic objects and robotics. In one instance, Burton and Swinburne see an "automated cleaner" in the shape of a crab, that cleaned the "filthy streets" of London each night. Buildings are also replaced, or buildings not native to the time or place appear. London of the novel contains The Battersea Power Station, which was not built until the 20th century. In fact, Hodder includes an appendix entitled, "Meanwhile, in the Victorian Age . . ." (365), which describes the historical accounts of the characters he uses, as well as the buildings that did or did not exist in

Victorian London. The novel treats the historical setting and the historical persons by overlaying them with fiction and then offering the historical account of both after the narrative concludes. Along with its characters, the narrative flattens the setting.

To say the characters and the setting are flat is not to say that the overarching narrative of Hodder's novel is flat and/or linear. In fact, I would argue that the novel's curvature greatly allows for the determination of its manifoldness. To define characters as flat does not determine the overall curvature of the narrative, nor does a flat setting necessitate a flat narrative. Instead, the way in which the characters and setting should be first examined is individually. The examination will render one of two results; either the specimen under study will be rendered without curvature because there is no data for it, or the narrative's crippling amount of information layered atop the specimen will flatten in an act of smoothing for the ease of our comprehension.

Flatness is a generic property caused by the overwhelming pressure of singular planes of data that stack upon each other in narratives. It is the smoothing and overlaying of data in characters and setting that allows us to more easily read and interpret the narrative. In the conclusion of the novel, Burton walks down the street and contemplates his own world: "*It makes it seem as if, he thought, my world doesn't really exist*" (364). Burton's world does not exist: fictional narratives and stacks of data both inside and outside his specific narrative overlay his Victorian

London. The historical Victorian London that serves as the base setting of the novel, or the setting to which the setting and narrative refers, becomes hidden by the science fiction that pervades and tempers it. The anachronistic historical figures, the mismatched timelines of historical events, and the absconded or cherrypicked buildings of 20th-century London create a patchwork narrative with historical and fictional holes. Only through these holes do the small portions of a historically accurate Victorian London show. Burton visits a clairvoyant, Countess Sabina, who seems to momentarily step out of the narrative to see what the we see:

I will speak. I will speak. I will speak of—of—of a time that is not a time. Of a time that could be. No! Wait. I do not understand. Of a time that *should* be? Should? Should? What is this I see? What? She fell silent and rocked backward, forward, backward, forward.

(149)

When looking at the narrative holistically, the historically accurate portions are lost among the distorted, steampunked London that is created, or recreated. Victorian London as we understand it historically has vanished because fiction and misplaced, or selective, history obscures it by resting atop it.

The growing inclement weather and Burton's own sense of dissociation from London highlight the obscuration of the history in which London and Burton derive. The first mention of weather is after Oxford leaves the meeting of the Royal Geographical Society after hearing that

Speke shot himself in the head before a debate with Burton. Historically, there is no surety that Speke shot himself or if he was accidentally wounded during a hunting accident. At face value, the opening of the novel is built upon this historical account. In the fictional narrative, when Burton leaves the meeting the “fine weather was dissipating,” with “the temperature falling” (Hodder 18). At this point in the novel, there is no indication of tampering and no indication of futuristic elements. Oxford even hails a traditional hansom cab. The description of the weather is more telling. The very end of the first chapter introduces a science fiction, anachronistic element:

“Traditional or atmospheric railway, sir?”

“Atmospheric.”

“Yes, sir.”

He was handed the train timetable. The next atmospheric train was leaving in fifty minutes. Time enough to throw a few odds and ends into a suitcase and get to the station.” (26)

The dispelling of the fine weather nods to introduction of the foreign device that did not exist in the 19th century. The next mention of weather follows a section in which velocipedes, rotorchairs, steam-horses, messenger parakeets, and greyhound dog messengers are introduced. The layering of fictional elements and obscuring of historical Victorian London elicits a response in the weather. The weather, when Burton walks out of his home, “was bitterly cold—unusual for September. . . The

thickening pall wrapped each gas lamp in its own gold aureole” (4). Immediately following is an “unusual” sight for Victorian London, a “steam-driven, one-man vehicle” passes. As the narrative of Burton becomes increasingly unlike the historical account of Burton, and as the setting of London becomes more unlike its historical counterpart, the weather and condition of London change as well. The “mist had condensed into a fog, a sickly sulphurous blanket which scratched at Burton’s eyes. . .” (55). Merely six chapters into the novel, after Burton’s encounter with Oxford and half-bred man wolves, “Wednesday tried and failed to dawn. It wasn’t until late morning that the fog allowed a smudge of daylight to filter through” (93). As if it were part of an ecological system, the obscuring of the historical Victorian London underlying the narrative of the novel and initially situating it is represented in the unusual and change of weather.

If we look at narratives and information as a form of flattening, the purpose of writing and reading seems depressingly useless, as we are reading a world that either does not exist or a world that we cannot quite know. The geometers of the 19th century grappled with dimensions they could never know or see. Literature and theory are not vastly different. It handles societies and cultures that it can only see obliquely—through historical documents, literature, art, etc. The feature that builds a bridge between mathematics and literary scholarship is reflective of the objective of non-Euclidean mathematicians. Non-Euclidean geometers of the 19th-

century were using non-Euclidean geometry to better understand how their world was constructed and how their contemporary systems of logic and numbers could be used. Understandably, the process was built upon historical achievements in mathematics, but it was also built upon overthrowing those achievements to examine and understand the moment in which they existed. Through this revolutionary process, they had to determine the flatness of themselves and their world in order to better understand the manifoldness of the space in which they lived. They had to approximate the flatness to see the curvature.

Flatness approximates a plane. Approximation identifies a value or a characteristic that is nearly correct but not exact or precise. My aim is not to demonstrate how literature can better approximate the society or culture it intends to represent. In fact, Hodder's novel specifically mangles the historical moment it represents to bring the narrative closer to us. Instead of representing the 19th-century, the novel rather integrates modern technology and characters to offer insight into our own culture. The clairvoyant of the novel tells Burton that "it is false, this path, yet you [Burton] walk it and it is best that you do so" (149). Steampunk as a genre works specifically to contort history and revolutionize the past to unveil the present. However, directing us to the unflattening process that occurs as reading progresses brings the text closer to the self. Distortion occurs as a result of such a motion and allows us to understand the manifoldness of the text through layers of data we are interconnecting. Burton is correct in

saying his world does not exist. Burton represents a 19th-century mind because he is a 19th-century character, and the world in which he inhabits is a creation and reflection of a 21st-century mind. The world is a mingled body of ideas about a historical moment and a current one, and its mingling obscures historical moments from which it borrows.

To first read along curvature, we must understand that space and narrative are not flat or smooth: they *have* curvature, and this curvature includes indentations and bulges. Narrative curvatures in the genre of steampunk are especially rife with imperfections, as the genre explicitly exaggerates such imperfections to allow us to build connections with and within the narrative. Through steampunk “the truth is broken and the lie is lived,” and obscuring the truth in partialities allows us to live a lie: fiction allows for us to make connections to our own world (Hodder 149). The distortions and imperfections bring us closer to understanding the manifoldness of the text and approximating its shape, as well as the image it is trying to reflect. To return to Hodder’s language, if reality blinks, we need to understand what motion happens when our eyes are closed in order to understand what our eyes perceive when they are open. Narratives are no different.

Chapter III:

Finding Manifoldness; or, Steampunking the Stacks

Mingled Minds, Distorted History, and Half-Breed Bodies

Reading *along* curvature reveals that narratives locally appear flat, as do settings and characters, especially in narratives that suppress historical events through fictional elements or selective history. A broader view reveals that narratives do have curvature, and that curvature has imperfections and areas of warping or distortion. In looking at the areas of distortion—reading *through* the curvature—we are able to unflatten narratives, characters, and settings. Unflattening and giving dimension occurs when reading for embeddedness (manifoldness) historically, culturally, and narratively. The moments of historical warping in narratives are springboards for analyses: distorted moments become the obvious points of interest that can help discern and build interconnected neighborhoods of information and understanding. They are points that we latch onto because they are more recognizable and understandable. Instead of looking at one layer of data and examining a specimen (character/setting/narrative) through a single, flat layer of information, we sift through several layers and interconnect that information with other stacks of data. We build understanding through an interconnected neighborhood of information that pools data from the culture surrounding a text and our own culture as readers. We reject, accept, remove, ignore, synthesize, or include information in order to craft an understanding of

what we read. We give dimension to what we read through this sorting. We un-vectorize, or unflatten, information and treat portions of a narrative in the same way operations work in a matrix: we mathematically treat a stack of narrative with a theory or level of understanding and then attempt to treat another stack of narrative with the same theory or method of understanding. By building neighborhoods of information and understanding, we try to give dimension to narratives, characters, and settings in a methodical, mathematical manner.

The flattening of narratives and characters is not a negative process, nor is flatness a negative attribute. In fact, flattening and flatness are, collectively, the exact tools that allow us to give shape to ideas, and flatness is the very first step of the unflattening process. We must understand the flatness of all characters, meaning that all characters have flatness to them. From flatness, we give dimension to narratives and characters by reading *into* them and giving interpretation *to* them. In unflattening them, we inevitably distort characters and narratives. The final process of unflattening acknowledges distortion and locates where it lies in order to tell us about ourselves and our society. The discovery of a text's compatibility to our own temporality describes its embeddedness. The multi-step process of unflattening in a conceptually mathematical manner describes a text's embeddedness in our own cultural moment, and the unflattening process requires us to step back from our ourselves and our moment to interpret our own understanding. We must temporarily

remove ourselves from our own limitations to read how our own interpretations distort texts and history to offer commentary on our own culture.

I want to momentarily return to the analogy of archaic transparencies to illustrate the process of unflattening and determining manifoldness. For simplicity, I offer a single, cartoonish transparency with an image of a slightly angry dog (fig. 7). I then offer a second sheet of a person in a hat with a cat (fig. 8). The stacking of the two offer a new way of thinking about both images (fig. 9). The first image of the dog, which serves as the central and primary image, becomes fixated, physically and informatively, under the weight of the second transparency. The examination of either transparency in the stacked column will now inevitably include both images during the interpretation process. The image of the dog and the meaning it carries is compressed under the image and meaning that the man with the cat carries. The original image of the dog becomes flattened. Fechner's shadow man returns to mind when examining the stack of information.

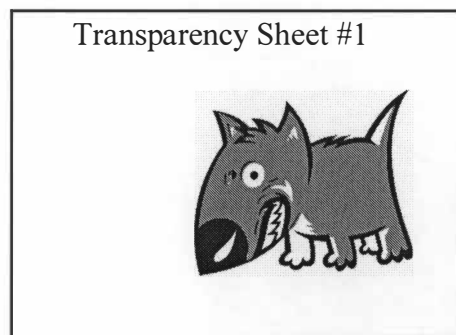


Figure 7

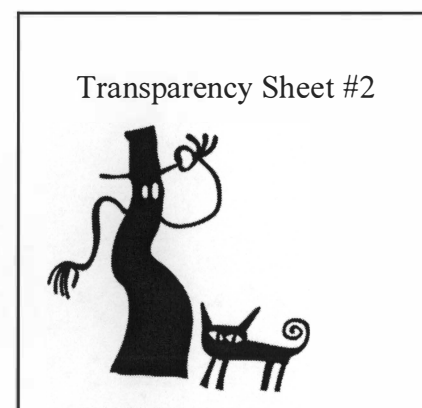


Figure 8

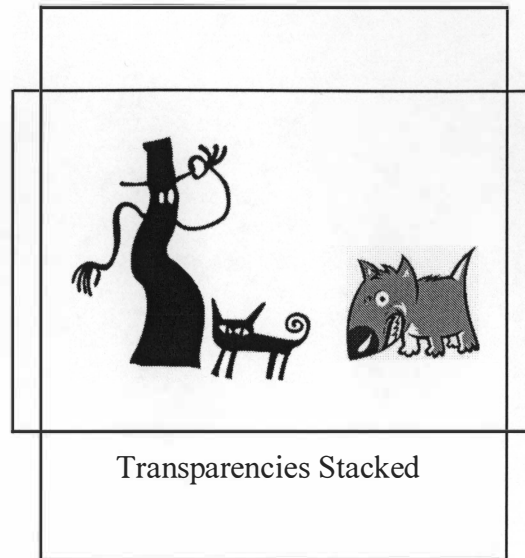


Figure 9

The original image of the dog is now dependent upon the new data while trying to retain its original form and meaning, just as the shadow man is dependent upon the existence of his three-dimensional man. The transparencies offer the “back and forth” motion Fechner outlines. Just as the image of the person and cat offer data *down* the stack of transparencies, the dog offers data *up* the stack. The dog may be angry because of the cat’s presence or because the dog mistrusts the person in the hat. Simultaneously, the person may be a suspicious character because of the dog’s reaction. The example is simple and, while it only offers two layers of data for interpretation, the process works among larger stacks of information. We sort through and read information that is moving back and forth between layers of data, and we read the motion, or we unflatten

it, to create interpretation and understanding. The distortion created creates a manifold.

When we unflatten narratives, we create connections between stacks of data and, in doing so, bend and blend the data stacks. Michel Serres, in *The Five Senses: A Philosophy of Mingled Bodies*, highlights the effects of the unflattening process and offers “mingled bodies” (29). Mingled bodies more accurately demonstrate how we unflatten narratives or characters and find interconnecting stacks of information to form understanding. Serres uses the term to describe the intermingling of senses, especially when describing sensations of human skin. Using “The Unicorn in Captivity” as his overarching metaphor, Serres argues that “the five or six senses are entwined and attached, above and below the fabric that they form by weaving or splicing, plaits, balls, joins, planes, loops, and bindings, slip or fixed knots” (60). The tapestry results in a visualization of the skin’s sensations as “separate islands, but also as a continuous variety, with mingled regions or states. It totalizes and adds together these two sorts of varieties: it mingles or juxtaposes the juxtaposed with the mingled. What results from this is called variable” (Serres 62). I use “mingled bodies” because information and interpretation are entwined and attached together. Components in a constructed neighborhood of information build a larger concept in interpretation.

The success of steampunk hinges on the hybridity of history and fiction, science and literature, and future and past. I position each set as

dichotomies because mathematically they must be, but in steampunk they work more as fluid fusions that have seen and unseen networks of connections between them. Steampunk often illustrates interconnectedness through geometric means, through manifoldness, or non-Euclidean methods. Steampunk cannot be categorized as subtle, and its deliberate exaggeration, manipulation, and transparency can be used to direct us in *how* we are reading by blatantly showing us *what* we should be noticing in narrative. While I do not argue that steampunk is necessarily a narrative manifestation of mathematics, I do find that mathematics lies in part of its foundation. By examining its manifoldness, steampunk serves as a textbook to read non-Euclidean narratives through obvious historical, temporal, and narrative manipulation. The calculation of a narrative's manifoldness offers insight into how we begin to distort narrative. In a sense, our agency as readers gives narrative unpredictability because interpretation depends upon the network of relationships we construct between the text and ourselves.

Hodder's novel blends history with reality, which is a key feature of its steampunk genre. An illustration (see fig. 10) helps to understand the overall geometric overlap between the fictional and historical in Hodder's novel. One cube represents a mass of historical information, and the other cube represents a mass of fictional information, or narrative. The three-dimensional cubes meet and intersect. In this instance, they mingle. In his introduction to *The Five Senses*, Steve Connor says in relation to Serres

that “noise means relation, passage, variation, for it rises in the spaces between fixed points and positions” (Connor 10). The figure suggests a perfect mingling of the two bodies, but Hodder shows that the intermingling is not a perfect mixture of both cubes. Rather, it is a variance of both, creating a new, asymmetrical body.

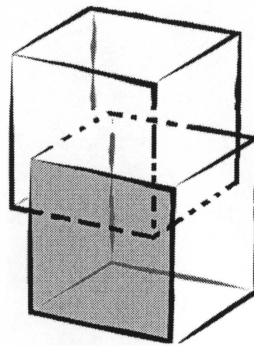


Figure 10

There is inevitable distortion that occurs while moving through this space and moving to intermingle. As the components from one cube push and pull against the components of the other cube, bending and distortion of both occur. Perhaps Connor’s phrase, “fluctuating contusions or spaces of implications,” serves as a better description of the intersecting spaces. The three-dimensional cube serves as a representational dimensional body that is composed of accumulated information. Each three-dimensional body, like the human body, carries features and attributes that are carried both within and outside of the body. The intersecting cubes demonstrate the external interaction, but they also allow us to see that their intrinsic features, perhaps otherwise invisible to us, mingle.

The illustration provides an example that is understandable and visible to three-dimensional beings like ourselves, but the four-dimensional is neither physically or perceptually achievable with our dimensional limitations. Instead of seeing objects in a four-dimensional state, we experience the after effects of four-dimensional movement, and we see the symptoms of four-dimensional existence: we see *mingled bodies* instead of *bodies mingling*. As Serres tries to pinpoint the location of the soul, he determines that “the soul is the point where the I is decided” (20). He outlines that the soul is the intermingling of the tactile sensations and the outside world, where “consciousness belongs to those singular moments when the body is tangential to itself” (20) Keeping Serres’ view in mind, I argue that four-dimensionalism and non-Euclidean narratives are not necessarily singular moments when the body is tangential to the self, but when a body, or body of text, can see forward and backward through an accumulation of information to become aware of itself between the past and present. Just as the intersecting cubes illustrate, history mingles with fiction and the past comingles with the future to create what Serres might call “high-relief sites of singularity in this complex flat drawing, dense specializations” (52). I avoid the term singularity because while it does suggest a distinctiveness of character, it also refers to the infinite in physics. The fixation is on flattening and unflattening rather than the infinite in space-time. However, the area of overlap is dense in that it draws from two sources and bends both to create

a pocket that can only be ordered when referring to our own, modern understanding of history and culture.

Burton acts as the narrative's non-Euclidean character and reader, but Burton also fails as a non-Euclidean reader because he does not have the same knowledge or agency that we have. Hodder gives Burton's character the ability to momentarily step away from the narrative and sit next to us, allowing Burton to momentarily overcome the limitations of being a character in the fictional narrative. When placed aside us, Burton senses a movement or change in the direction of his life, as if he feels the historicity of his character transforming into a more fictional form. The change in weather, suggested earlier, begins to intrude on Burton's mind and acts as a force of non-Euclidean thought:

As he pushed on through the bilious fog, the fumes seeped into his bloodstream, starving his brain of oxygen. He began to feel a familiar sensation, a feeling which had haunted his malarial deliriums in Africa. It was the notion that he was a divided entity; that two persons existed within him, ever fighting to thwart and oppose each other. (115)

Burton's character begins to understand that the historical accuracy that founds his character in the opening of the novel is being suppressed, and this new Burton is being carried into a new fictionalized narrative timeline. Burton repeatedly has moments in which he feels himself being split. Halfway through the novel, as he is investigating the man-wolves

plaguing London, as well as Spring-heeled Jack, Burton sees a news article about an expedition to answer the question of the Nile. The narrative has carried Burton far from the first scene of the novel, which was the debate on the source of the Nile. Upon seeing the news, “Burton was suddenly aware of that peculiar sense of being divided....

Geographical exploration now belonged, he sensed, to another version of himself; to the *doppelgänger*” (165). Countess Sabina, the clairvoyant, justifies Burton in his feeling by telling him that “This cannot be, for both paths are trodden! Both paths! How is this possible?” (149). The possibility arises because Burton attempts to read his own manifoldness by temporarily existing outside the confines of the narrative.

Burton’s non-Euclidean understanding and struggle of identity is comprehensible when placed under Fechner and Helmholtz’s ideas of non-Euclidean space. If “a positive being is inconceivable without the contrast provided by a negative being” (Fechner 131), then the antithesis of Burton’s fictional character, as we see it, would be Burton’s historical character as we know it. Burton has one non-Euclidean, higher-dimensional experience that again allows him to sense his two selves:

. . . he explored the presence of the invisible *doppelgänger* that seemed to occupy the same armchair as himself. Oddly, he found that he now associated this second Richard Burton not with the delirium of malaria but with Spring Heeled Jack.

He and his double, he intuitively recognised, existed at a point of divergence. To one of them, a path was open that led to Fernando Po, Brazil, Damascus. . . For the other, the path was that of the king's agent, its destination shrouded. (140-41)

In this pivotal moment, Burton recognizes what Fechner describes as “an imaginary being entirely dependent” (Fechner 131) upon the existence of another being. Naturally, he cannot see as we see because his Victorian mind does not have access to the history that we have. What Burton does experience is the “back and forth” nature of the historical accounts of himself and the fictionalized version of himself that inhabits the novel. The face of Burton's character is constantly shifting from fictional to historical, just as the Necker cube (see fig. 2) changes its faces by invisibly rotating in space.

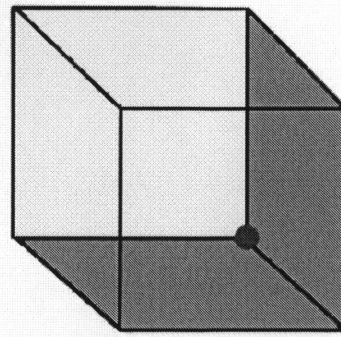


Figure 2

He cannot escape the motion, as the entire narrative is dependent upon the history of Burton to design the fictionalized Burton. Burton feels himself constantly shifting between two faces—the historical and the fictional. Just as Clifford suggests, Burton's own view of himself could lead him to

the conclusion that his doppelgänger's world, the historical Burton we know, "may be the true state of things" (Clifford 86). In fact, what Burton cannot see, which we can, is that his characterization holds true to the character of the historical Burton. We see that the fictional Burton responds in a way that the historical Burton might if placed in such a situation, holding true to Fechner's ideas that "neither a genius nor a fool can behave differently than his shadow." For us, the historical Burton is the "true state of things," but the fictionalized Burton believes his own experiences to be the truth. To Burton, his fictionalized form is the truth, but our knowledge demonstrates the back and forth movement created in the space he inhabits.

Our knowledge of Burton poses a question of how history's treatment should contribute to manifoldness, especially in steampunk. Hodder's novel rampantly borrows and absconds history and recklessly uses it within the narrative; therefore, manifoldness can be considered in one of two ways. Should manifoldness be determined by the sheer *amount of history* used to construct the fictional narrative, or should the manifoldness be determined by the *accuracy of history* that composes the narrative? The opening of the novel can serve as a case study to explore a question of historical use or accuracy.

The novel opens with Burton on September 16, 1861, at a meeting with the Royal Geographical Society in which he and John Hanning Speke scheduled a debate on the source of the Nile. Burton learns before the

debate that Speke shot himself in the head during a hunting expedition. Oxford, despite his psychological unraveling, can serve in part as our historical fact checker. Upon hearing the date, Oxford disagrees and tells Burton that “It [the debate] was 1864 not 1861” (54). Oxford refers to history as we, the readers, understand it. The historical Burton and Speke debate was indeed scheduled for September 16, 1864. Before the 1864 debate, Speke received a gunshot wound to the chest. Whether it was an accident during hunting or an act of suicide is still unknown. Therefore, while the fact that Speke receives a gunshot wound is historically accurate, the fictional narrative places the wound at his head, rather than his chest, and it definitely assumes that a hunting accident caused the wound. Historically, the opening of this novel is thoroughly embedded in a historical moment between Speke and Hodder in 1864, and, in this instance, it minimally removes and forgets information surrounding this moment. In terms of accuracy, especially when Burton recounts the attack of Berbera, the narrative retains key historical facts. As the narrative describes, Burton was wounded in the attack of Berbera. The narrative describes Burton with “his face bandaged, blood staining the linen over his cheeks” (23). During the attack of Berbera, Burton received a spear through the jaw. The cause of Burton’s wound in the narrative is not apparent, but the narrative directs the wound to the general area with historical accuracy. The foundation of the novel mostly rests on historically accurate information. Some of the details are either lost,

eliminated, or smoothed for the narrative, but the opening of the novel proves primarily accurate.

The accuracy fails, however, when Spring-heeled Jack enters the narrative. After Burton's encounter with Oxford, Burton becomes an agent to the crown and investigates paranormal sightings in London. Shortly after, the fictional Burton breaks his engagement from Isabel Arundell, who the historical Burton actually married in 1861. The historical accuracy of Burton's actions diverts forty-four pages into the narrative, but while his actions may falter historically, his character does not. Surprisingly, Burton's character is drawn with shocking accuracy. The novel depicts Burton as an apt swordsman, a master of disguise, a scholar of mysticism and the orient, as well as an opiate addict. Edward Rice's biography of Richard Francis Burton, *Captain Sir Richard Francis Burton: The Secret Agent who made the Pilgrimage to Mecca, Discovered the Kama Sutra, and brought the Arabian Nights to the West*, justifies the characterization that Hodder makes. Burton *was* a master of disguise, who later overcame addictions to opiates and alcohol, but Hodder uses the characteristics to make Burton more fit for the fictional narrative in which he participates and unfolds. The almost fictional-like quality of Burton is not lost on Rice, who introduces Burton's biography by addressing the notion:

If a Victorian novelist of the most romantic type had invented

Capt. Sir Richard Francis Burton, the character might have been

dismissed by both the public and critics in that most rational age as too extreme, too unlikely. Burton was the paradigm of the scholar-adventurer, a man who towered above others physically and intellectually, a soldier, scientist, explorer, and writer who for much of his life also engaged in that most romantic of careers, undercover agent. (Rice I)

The historical man who would fluently speak 29 languages; successfully completed a pilgrimage to Mecca under the guise of a “Persian prince;” left the city of Alexandria “because he was bored” (Rice 184); worked as an intelligence officer for England; and was sponsored to explore Africa and the Orient, seems a fitting choice for a fictional narrative, as the historical account of Burton is already unbelievable.

Burton’s valiant attempt to decipher and read his own narrative in a non-Euclidean manner ultimately fails because his 19th-century mind simply does not have the same amount of information as we do, and because of the history upon which Hodder constructs his novel. Burton’s character, instead, offers a counterexample to our agency as readers. Burton is understandably conflicted about his own identity because, to him, his own experiences are the true historical account of his life. Burton’s crisis of identity only occurs because a futuristic entity tells him that he is supposed to live another life. To us, the distinction between fact and fiction is clear, but Burton does not have access to this same information. Where we see a fictionalized version of Burton based on

historical fact, Burton only senses that another Burton in a different timeline somehow exists. For Burton, his experience, using Clifford's words, is "the true state of things" (86). Burton can feel himself vacillate between what we see as history and fiction, but Burton, as a 19th-century figure, cannot possibly see the results of the movement nor understand what that movement may mean. His agency is stripped along with the information he needs to read himself as a distorted and hybrid character.

Burton's non-Euclidean moments help to demonstrate how the unflattening process brings the narrative closer to us. Burton's character inhabits a space, momentarily, between selves. The weather mimics these moments: "The sun had risen and was sending lazy shafts of light into the pale yellow fog. Black flakes were suspended in the pall, neither falling nor swirling about" (Hodder 121). Burton, like the black flakes, remains suspended between fiction and history during his moments of self-awareness. In these moments, we read Burton as both fictional and historical. Burton himself acts as if deciding which Burton to become, but the inevitability of the narrative offers him no choice. Instead, Burton becomes a body that is partially fictionalized and partially historicized—a mingled body. The hybridity and blending force us to understand more about how distortion is used to reflect ourselves and the stacks of information we are connecting rather than what Victorian society may have been like.

We build and interconnect sets of data to craft understanding. Hodder's fictional narrative can only make sense to those who connect the futuristic, science fiction elements to themselves: we readers have access to stacks of information that connect to modern technology, historical documents, literature external to the narrative, and understandings of narrative techniques. Distortion is read by choosing two points on a manifold, reading its curvature, and seeing the movement between the two stable points. In Hodder's novel, the present and the past serve as stable points, and the distortion occurs between the two as we perform the unflattening process. Interpretation of text is not to translate or transpose; instead, it is the reading of a body of text through the lens of data accumulation.

Just as Burton proves to be an unsuccessful non-Euclidean reader, Oxford also proves unsuccessful in the opposite manner. Where Burton succeeds in momentarily stepping out of his dimensional limitations to read himself but lacks information to interpret, Oxford has all the information we have but cannot step away from himself to interpret his own character or narrative. Upon his second meeting with Burton, according to Burton's sequential timeline, Oxford claims he must "Restore, Burton! Restore" (126). Oxford's motivation throughout the novel is to "repair the damage" he caused through his time traveling (126). From the moment Oxford learns that the year of the Burton-Speke debate differs from the historical date, he becomes increasingly distressed. Burton

is distressed by a narrative that *should* be, whereas what increasingly distresses Oxford is what he believes *shouldn't* be. Oxford's narrative offers his perspective of the first encounter with Burton, whereas the first half of the narrative illustrates Burton's confusion as a 19th-century individual encountering a mysterious assailant. Oxford's perspective offers confusion of a different kind:

Edward John Oxford, the scientist and historian, froze. How could this be? He knew the facts. They couldn't be wrong. They were well documented. Speke's death was one of the great mysteries of the period. Biographers had endlessly debated it, wondering whether it was suicide or an accident! Slowly, he absorbed the things he'd seen, the strange machines and the weird animals.

(335)

Oxford sees the results of his movement through time and reads the mingled bodies as incorrect. Unlike Burton, Oxford does not see how the changed Victorian London can possibly be real when he understands Victorian London as a historical place. Oxford thinks in the linearity that Burton is living as a Victorian, and Burton is thinking in the non-linear, non-Euclidean terms that Oxford is experiencing. Oxford ironically cannot see in terms of the Necker cube, and perhaps this lack of perspective stems from a loss of "permanent coordinates" (Hodder 351). The helmet Oxford wears to overlay information relies on the "tethering" he calibrated. Before Oxford's death, he tells Burton that permanent coordinates "make

us who we are, Burton. They give us identity” (351). He admits to erasing his coordinates, which suggests that his “tethering” is lost. When considering “tethering” as a means of working with and reading mingled bodies, tethering is the selection of two fixed points on a manifold. For Hodder’s novel, the points of tethering comprise of a moment in 2202, which is Oxford’s present, and a moment in Victorian London, which is 1861 for Oxford’s ancestor. Once Oxford murders his ancestor, the tethering point in the past is eliminated, which simultaneously eliminates the tethering points of his future. Oxford is an unsuccessful non-Euclidean reader and non-Euclidean character because does not have not fixed points to read curvature: he no longer has fixed pieces of information in which he can connect or read.

Oxford’s failure and death suggests that the momentary removal of ourselves from our temporality does not determine the success of non-Euclidean reading. In fact, Oxford’s death offers a warning and a necessary step in the unflattening process. Temporary removal from our own temporality is needed to unflatten characters, but that momentary removal must be situated between two concrete and stable points of information. Therefore, reading manifoldness and crafting interpretation of narrative must occur between two chosen points. By establishing these points, the movement between the two can clearly be read for distortion. To think in terms of Riemannian space manifolds, or the embeddedness, we are calculating and discovering the “conglomerate of (local) spaces”

between stable points. As readers, we must tether ourselves to stable points in order to successfully work and move between those points.

Reading the motion and distortion in between us and the text, or the text and an interpretation, includes the “back and forth” exchange of data. Just as the dog in the transparencies sends data upwards, the cat and person send data downwards through the stack. In Hodder’s novel, anachronisms and environmental changes are symptomatic of an intermingling dimensional distortion. There are obvious futuristic anachronisms through the novel, such as rotor chairs, but anachronisms that reach beyond the historical moment of the Victorian era find their way into the narrative’s society. When Burton and Swinburne walk into the Tremors, an area pub, the two sit next to a man who “wore an unfashionably long jacket” and “a high collar” (Hodder 151). Just as the intersecting cubes illustrate, the past comingles with the future. Algernon Swinburne, sidekick to Burton, acts as a chimney sweep in a plot to uncover the location of missing chimney sweeps. Master Sweep Vincent Sneed, or “The Conk,” wears “baggy canvas trousers held up by a pair of suspenders, a filthy shirt with a red cravat, and a bizarre blue surtout with epaulettes, which may well have been a relic from Admiral Nelson’s day” (186). The anachronisms result from dimensional overlap, or where the points where the two squares meet. These overlapping points not only function as the passages to the space in which the historical and the fictional intermingle, but they also function as the means for non-

Euclidean narrative to occur. The anachronisms became a result of successful distorting and comingling of history with fiction, “unfolding and enfolding in itself” (Connor 13). Standard signifiers of these overlapping points include disorientation of time, space, direction, or a combination of these elements, as well as the obscuring of the setting by environmental elements.

If distortion signals an intermingling of bodies of texts or data, then the historical inaccuracies and obscurations become more significant to the narrative and to interpretation. The three-year difference between the beginning of Hodder’s novel and the historical debate between Speke and Burton acts as an immediate deformation of time and history. The slippage of history reads in the anachronisms. One afternoon, Burton receives a visit from Damien Burke and Gregory Hare, who retrofit a tubing-messenger system in Burton’s home. While the first names do not match the historical Burke and Hare, the fictional duo outline their odd and specific duties:

‘One last thing, sir. Mr. Montague Penniforth’s remains were recovered by the river police in the early hours of this morning. His widow has been notified, his funeral paid for, and her pension arranged. In the future, should you encounter such unfortunate occurrences, if you can manage to have the deceased either left alone or stored somewhere, we will act the moment you notify us to ensure that disposal is civilized and respectful.’ (200)

Hodder alludes to the historical Burke and Hare, but the history of the pair does not align with Burton's narrative. By the opening of this novel in 1861, Burke should have been dead for 32 years, and the death of Hare is estimated around 1860. If their historical resurrection from the dead to play a part in Hodder's novel is not obvious enough, Hodder even draws attention to them by dressing them in clothing uncharacteristic of the period. Both are described as wearing "back waistcoats" accompanied by white shirts with "Gladstone collars" (198). To accompany their coat and high-collared shirt, they both wear knee-length breeches, "yellow tights," and "buckled shoes" (198). Hodder is explicit after his description and remarks that "their style was at least fifty years out of date" (198). From the moment we begin reading the novel, we are reading distorted bodies.

In a review of Hodder's novel (2010), Thomas M. Wagner says of the novel, "Does everything have to do with everything else? Why, of course, but I'll leave you the pleasure of experiencing how Hodder pulls off this Rube Goldberg narrative" (Wagner). The idea of the Rube Goldberg mechanism in Hodder's narrative offers direction in how reading offsets a chain of distortion. While the opening distorts time by only three years, the narrative offers a chain that builds to larger distortions, such as Spring-heeled Jack being a time traveler. However, perhaps a Rube Goldberg machine acts too linearly to accurately fit the structure of this novel. Instead, I find a perpetual motion machine, which is commonly found in steampunk, to be more accurate than a Rube

Goldberg mechanism. While the chain of events in the narrative does work through a complex chain of actions, the reading and unflattening process is self-perpetuated from the single act of beginning the novel. The outside force acts as a source of energy for distortion to continuously function and move. Interpretation is similar in that it is an idea that acts as the source to self-perpetuate thought.

The mingled-ness can only occur when the narrative undergoes unflattening, instigated by us. Serres says we are “Half-breeds in our own thought,” and a “hybrid of our existence” (62). At this point, the question of the self, of the true identity of the character, and of our own identity as readers comes into question. Serres takes the skin he flattens later in his work and wraps it around the three-dimensional skeleton of the human body, making us “the bearers of skewed, not quite flat, unreplicated surfaces. . .” (21). He suggests the fluidity of identity, which can fluctuate between the self and the world to present its “other face” (24). Half-breeds of thought, a word I purposefully used earlier in the first chapter, indicates an interaction that inhabits a space higher than a three-dimensional one. In this higher-dimensional space, motion serves as the mechanism for intermingling. The contemporary mind moves between stacks of information, some of which encompass time, and builds knowledge through sifting and selecting data to interconnect. Similar to Burton, we constantly shift backward and forward between stacks of information to craft understanding.

Four-dimensional texts vacillate between historical or cultural accuracy and a fictional telling. These texts demonstrate their own movement through their distortion of both. Four-dimensional characters are those who vacillate between their historical self and their fictionalized form. The result of this movement is distortion of both. Both four-dimensional texts and characters are those that change as data builds upon them, forcing us to unflatten them and interpret stacks of data. Hodder's novel presents characters that are aware of their half-breed nature, and we should explicitly look to these characters to understand ourselves. Burton, momentarily outstepping his dimensionality, sees himself vacillating between history and fiction. The key to these moments is that he is using them to understand himself. We enact a process of unflattening, interconnecting stacks of information, to better understand ourselves. Just like the shadow man, narratives are dependent upon us as much as we are dependent upon the narrative: "A positive being is inconceivable without the contrast provided by a negative being: it owes its illusory existence to its antithesis" (Fechner). Yet, the moment an object is reflected, distortion occurs. If we move further away from a mirror, if we move further away from the narrative, the image flattens. Yet, when the narrative is moved closer to us, to reflecting us, the more distorted it becomes. We, as readers, through mathematical terms, are calculating the manifoldness—the network of relationships between data—of a body of text: we are

calculating its mingled-ness. In doing so, we are reading mingled bodies
and spaces of distortion in order to better calculate ourselves.

Conclusion and Rebellion:

Riemannian Reading and Modern (Present) Tensors

A professor once asked my graduate class the difference between literature and stories. After we theorized and philosophized, she told us that her undergraduate class asked if we were just reading *too much into* literature. My professor responded, “maybe we read *out* of literature.” While I love the idea, and adore the language utilized to construct such a concept, I cannot help but find it disingenuous. To read *out* suggests that there are concepts intrinsic to the narrative. In a Euclidean frame of mind and in a linear narrative, features may be inherent to a narrative, but considering Hodder’s novel, I argue that literature has no intrinsic geometry. Novels have no inherent characteristics, no innate motifs, and no inborn symbolism. Instead, we make assumptions about a narrative and offer our own metric of interpretation and understanding.

The suggestion I make sounds understandably dismal when thinking about the purpose of literature, and my methodology may seem overly critical of literary studies. My methodology is not a means to reformulate or replace literary studies, as one does not supersede the other. Non-Euclidean geometry has not replaced or marginalized Euclidean mathematics. As Fechner and Helmholtz reiterate, one is not possible without the other. Thinking of narrative as linear and Euclidean will rest at the foundation of interpretation because our minds are trained to see and think in Euclidean terms. What I want to stress, instead, is the limiting and

oppressive nature of Euclidean narratives. If such were true that narratives are exclusively Euclidean, then the scope of literary criticism would be far narrower and the power of literature increasingly diminished. The plays of Shakespeare would be exhausted to their linear end and forgotten in society. We would toss aside a Dickens novel after outlining its historical context. To say that a novel is Euclidean is to say that it has an exhaustible lifespan: it is to say that its richness will falter after it is fully explored. It is in this thought of linearity that I primarily see the darkness and limitations of literary criticism.

In Euclidean thought I also find the skepticism of humankind's ability of literary greatness and scholarship. To suggest that Euclidean narratives are exhaustible is also to suggest humankind's ineptitude. If literature become linear and exhaustible, then either we no longer read or we no longer think. The relevancy and richness of text stems from a contemporary perspective on a piece of text. I carefully choose the word piece because a piece of understanding is all we can calculate from our own metrics of reading.

Hodder's novel highlights the particular power of steampunk narratives to bear the burden of exaggerated flattening *and* unflattening to confiscate our agency, and in doing so we see the invisible unflattening processes that occur when we are not consciously examining our interpretation. Steampunk narratives are not the only ones that flatten characters and narratives for the betterment and ease of the unflattening

process, but steampunk offers a more explicit means of highlighting the interaction of unflattening between reader and text by taking on the powers of the reader. The problematic use of history in steampunk demonstrates in plain view a singular form of metric that cannot measure in exactitude the space it attempts to describe. Hodder's novel, as well as many texts within the steampunk genre, enact the flattening and unflattening before us to demonstrate just how much our own forms of metric distort a narrative. Steampunk uses an established metric to actively distort history, just as our metric might. We can only clearly see the measurement, unflattening, calculation, and distortion because the text does it for us by obviously distorting what we would call historical truths, or historical fact.

Through a reader-metric perspective, the author seems distantly removed from the interpretation and meaning-making of a narrative. I see the value in coproduction of meaning occurring between an author, text, and reader; however, coproduction expropriates some of the reader's agency in the interpretation process. A metric may include the author, or even previous academic writing, but these elements are simply parts of the interconnected neighborhoods used to construct interpretation. An author's metric is not necessarily a means to measure our own metric. Mishra and Mishra offer an example to explain the consequences of assuming a metric to be correct:

Let's consider the analogy of a bug moving on a transparent globe to illustrate this point. Assume that the bug is traveling along the great circle, which is the shortest (geodesic) path on a globe.

However, assume further that we cannot observe the bug's actual movements. All we can see is the shadow of the bug's movement, including the start and end points on the floor caused by a light bulb kept at the top of the globe. We are unaware of the shape of the object on which the bug is actually moving. (Mishra 19)

Since we see the shadow on a flat floor, we assume that the bug must be walking on a surface similar to the floor—a flat one. If we marked the starting and ending points of the bug with a dot, we would naturally draw a straight line between the two to calculate the shortest distance the bug would take. However, since the bug is actually on a curved surface, the path would not follow our line and therefore make little sense to us: “we would find the bug's path to be quite irrational . . .” (Mishra 19). If we try to calculate a narrative's shape by a movement we cannot directly see, we are assuredly going to offer a distorted measurement and a measurement that may not completely describe the movement of an element traversing across it. Coproduction suggests a kind of equal collaboration with others to craft interpretations of texts. Even if we were to examine coproduction mathematically, we would find the space between the co-producers to only describe the minimal space between the two interpreters. In manifolds, a small Euclidean space cannot describe the overall shape of the entire

space. Perhaps my wariness of coproduction stems from its suggestion of equal efforts from collaborative parties, whereas the geometry suggests a use of old data to formulate a better metric. I cannot see how coproduction can craft an interpretation that gives the equality to both parties that the term suggests when the metrics of our minds are never quite equivalent. We build our own understanding from other metrics, hoping that our metric may better calculate a text, interpret a situation, communicate with others, or make a better decision. I am not arguing that texts are not shared *unless* readers bring to them experiences or assumptions, I argue instead that all texts are shared *precisely because* we read them with our own experiences, or own metric, in mind.

In a non-Euclidean space, *we* are the metric that we employ to calculate the surface of a narrative. Manifoldness becomes the embeddedness of a text in our own lives and our own culture. As an example, steampunk literature may be more embedded in our culture and our lives, at this moment, than Shakespeare or Chaucer because the technological progress of the Victorian era reflects the anxieties and levels of technological progress that we have been facing since the creation of steampunk in the 1980s. I offer this example because I am a scholar raised in an era of swift and transformative technological progress. Therefore, the literature I read has the metric of my own experiences and my own level of knowledge. To determine manifoldness of a text is to determine its manifoldness in our own lives and then our culture. We become the

Gaussian curvature tensor, or the means for differentiating between flat and curved space. We try and calculate how much a narrative bends away from us.

The tensor, now determined by the present us, approximates how similar a narrative is to us. The process, as outlined through Hodder's novel, involves connecting neighborhoods of information and stacks of data. Charles Lautman's description of Riemannian space helps to understand how our present tensor functions:

“Riemann spaces are devoid of any kind of homogeneity. . . Each vicinity is therefore like a shred of Euclidean space, *but the linkage between one vicinity and the next is not defined and can be effected in an infinite number of ways. Riemann space at its most general thus presents itself as an amorphous collection of pieces that are juxtaposed but not attached to each other.*’ (qtd. in Plotnitsky, “Algebras” 102)

Narratives, in Riemannian terms, are fragmented pieces of information that lack overall consistency. Hodder's novel demonstrates the “juxtaposed but not attached” pieces by layering historical information with fictional elements of narrative. When we read, shown as Hodder blends history and fiction to create a new historical-fiction, we attempt to build connections between fragments of narrative and narrative space. We use our experiences and knowledge to unflatten and understand narrative spaces.

Inevitably, when we use our own metric to unflatten narrative, our metric will not exactly approximate our match our experiences or the world in which we live. The mismatch of metric and narrative surface means that our metric is not entirely accurate. When I say this, I do not mean that our experiences or our experiences of a narrative are incorrect, as someone's experience cannot be incorrect. What I mean is that our metric can never fully calculate or approximate a narrative or its space. In Riemannian geometry, we cannot use local spaces to describe the whole space. As Lautman describes, the fragments in a space could be connected in infinitely many ways. This feature of Riemannian spaces gives literature its richness and relevancy. Our interpretation of a text is just one chain of data and one part of a sequence, and because it is merely one of many, our metric is not the only metric used to describe narratives. Our metric, our interpretation, is always a distortion of the space we read and approximate. When we read the distortion of narratives, we are reading ourselves through the metric we have assumed.

Hodder's novel offers an illustration of the intrinsic flattening of narratives, while his distortion of time, space, and history highlights the power we have when we read. We have an accumulation of history and knowledge behind us that we wield as geometric tools to unflatten and interpret narratives. However, we selectively and carefully sift through our history and knowledge to fine-tune our instruments of interpretation. Mishra and Mishra contend that the space in which we make decisions is

non-Euclidean, specifically with Negative Curvature. If we can treat our decision-making processes and thought spaces as non-Euclidean, surely our forms of interpretation and expression can be treated as such. We connect neighborhoods of data with precise ideas of who we are and in what culture we live. We cut, bend, blend, and stitch information together to create interpretation that has meaning to us. Interpretation becomes a non-Euclidean interaction between us and narratives, where we use ourselves as a means of differentiation—our present tensor. We cannot read *into* narratives, nor can we read *out* of them. We give ourselves, our minds, and our culture as an offering to give breadth and meaning to narratives; in a sense, we become a necessary part in a never-ending differential equation that gives meaning to human expression.

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