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CONTESTED KNOWLEDGES: A RHETORICAL ANALYSIS OF 'ECLIPSES FOR AUSTIN' BY PABLO VARGAS LUGO AT THE INTERSECTION OF ART AND SCIENCE

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by

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ABSTRACT

The debate on whether art has any cognitive value might be traced to the texts of early philosophers and theorists who have approached the matter. In general, art has been constrained to contemplation and aesthetic experience while its contribution to knowledge is often disregarded. Science, on the other hand, constitutes the main system of organized knowledge production and enunciation.

Contemporary artistic practices that address scientific knowledge tend to reformulate the latter in order to either produce new experiences with it or expand its cognitive capabilities. The works produced by these practices serve as artifacts that expose science's biases, axiomatic tenets, priorities, and limitations, as well as contest and complete the realms of experience in which science fails to provide an account.

As discursive artifacts, these artworks may be analyzed from a rhetorical framework and methodology in order to unveil their role in rearticulating science and producing responses to the

specific situation in which they come into being. Through a rhetorical analysis of *Eclipses for Austin* (2009) by Mexican artist Pablo Vargas Lugo, this thesis aims to identify and describe the way contemporary artistic practices operate to expand on knowledge produced from scientific inquiry and enunciation. The analysis, grounded in Lloyd Bitzer's idea of the *rhetorical situation*, has shown that these works address a rhetorical *exigence* (generated by the differences and similarities between art and science), are limited and enabled by *constraints* from both realms of experience, and produce a *fitting response* helps to expand the knowledge and understanding formulated by science.

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CHAPTER 1:

INTRODUCTION

I remember when, at a drawing seminar, the instructor explained that the act of drawing was, for her, rather a way of *knowing*, a way of approaching the object, instead of merely a means to represent it. Those words resonated strongly in my head. Her argument was, and I am paraphrasing, something like this: When one draws anything, let's say a tree, we move at least an iota toward a broader cognition of that particular tree (and, to some extent, toward *treehood* in general); the object, simply, becomes more *known* to us. That thought reminded me of the old debate regarding the cognitive capacities of art and, specifically, of representation. In thinking about these possibilities, I tried neither to exalt nor condemn representation and art as *ways of knowing*, but to discover if there is any possibility of expanding knowledge and understanding through the experience of a specific work of art.

I recognized later how some artworks have *taught* me specific things (actual facts) that I would not have known otherwise (or that would have required more time and effort to know by other means). For instance, from the series of paintings of wedding dances and feasts by Peter Bruegel the Elder (sixteenth century), I have learned that doublets (a wool or linen piece of clothing used over the shirt by men) were extremely popular in sixteenth-century Flanders, and that peasants used several ties to connect hosiery to these; from painter Frans Hals (active during the seventeenth century) I learned not only what a *rommelpot* (small friction drum) looked like, but also how it should be played; from the Edelheere altarpiece triptych I deducted the importance and popularity of Van der Weyden's famous Deposition painting during the fifteenth century, for it is one of the earliest copies of the latter.

It is clear that art, in this sense, can *teach*. In other words, it can provide us with a perspective on some aspects of reality that we can grasp and later remember in order to, ideally, expand our understanding or knowledge of some specific matter. This statement appears evident when art is understood as figurative representation; however, art equaled to figuration can also lead to a reduction of the functions of art. If we understand art only as figurative, it would be sufficient to acknowledge that most scientific facts are conveyed through the use of illustrations, diagrams, maps, and other visual (artistic?) forms. What would have happened to biology without the use of drawing (and later photography) for the sake of the taxonomical enterprise of the nineteenth century?

Evidently, a catalog of species without illustrations may have a very limited cognitive value, for these images *show* the visual appearance of plants, animals, and other beings. Nevertheless, this aspect also may be given by the inherent relationship between visuality itself and cognition;[1] in other words *to see* is *to know*. There seems to be a relationship between the visual dimension of things (their visuality) and what we understand as knowledge: "Thus the manner in which we have come to understand the concept of an 'idea' is deeply bound up with the issues of 'appearance,' of picture, and of image."[2]

This argument, however, seems to be more suitable to cognition over matters that display primarily a visual feature. In this sense, it would be easy to conclude that art *teaches*, because it *(re)presents* visuality. This ontological fixation of art with visuality makes it even more difficult to isolate and identify cognitive value in artistic practice solely, and it constitutes a critical mistake in any effort to discover knowledge through art. I would like to stress this distinction

[1] Chris Jenks, "The Centrality of the Eye in Western Culture," in *Visual Culture*, ed.

[2] Ibid.

because if we understand art as mere figuration, the possibility of knowledge through it would be given only by the fact that art *shows* the visual dimension of an object or, in more complex cases, freezes a visual stage of a processes or event. If we stand by this idea, there would be nothing to discuss since knowledge of the object being represented and its representation would be the same thing, i.e., its visual dimension.

What we learn from the botanical catalog from the nineteenth century is the shape, forms, and colors of the plants and leaves being depicted, which is, in fact, the knowledge that is being represented. This logic might lead us astray to a tautological loop and cannot solidly support the idea that art can serve the purpose of knowledge conveyance or expansion; it simply reinforces the idea that visuality is cognition, but demonstrates very little about how the artistic apparatus can contribute to the pursuit, assertion, or communication of any new or previously acquired knowledge.

On the other pole of the issue is the very idea of *knowledge*. I recognize that the use of the word can be highly controversial. I can *know* a person who works in my office; I *know* who he or she is by recognizing his or her facial features. I can *know* how to drive a car or ride a bike. In either case, the knowledge manifested is different. In the situation discussed in the first paragraph of this introduction (drawing a tree), there are different types of knowledge operating at once: there is knowledge of the tree (and *treehood* by extension) that the artist who is drawing experiences; there is also knowledge of what a particular, and, in general, a tree looks like that is experienced by the viewer; and there is also knowledge of how to draw trees that is exercised by the artist. The viewer can also experience a kind of knowledge if he or she has previous knowledge about systems of representation, about the kind of depiction the artist is using based

on a formalist analysis of the drawing, and the like. This list could be expanded as much as we want, for the way we experience knowledge operates in many levels and forms.

For the purpose of this analysis, I will utilize a more classical approach to knowledge, which could be better understood as *episteme*. In classic epistemology, there is commonly a distinction between three types of knowledge. The first kind of knowledge occurs when performing an action; it is practical application about how to perform, create, or transform something.[3] This is known as *practical knowledge,* like knowing how to drive or how to paint. Secondly, there is the type of knowledge experienced when one *knows* or is familiar with someone or something.[4] I think this would be closer to the idea of cognition through visuality since one knows a person for his/her features more or less in the same way that an object is known to us by the way it looks in a figurative representation. Finally, the third type is the "kind of knowledge you have when it is truly said of you that you know that some fact is true."[5] This is also known as *propositional knowledge*.[6] Therefore, propositional knowledge exists when a subject is positively certain that a *proposition* (i.e., a statement) is true. Propositional knowledge is often expressed with the following sentence: *S* knows that *p*, "where '*S'* refers to the knowing subject, and '*p*' to the proposition that is known;"[7] for example in "I know that apples are fruit."

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[3] Jeremy Fantl, "Knowledge How," *The Stanford Encyclopedia of Philosophy* Winter 2012, ed. Edward N. Zalta, http://plato.stanford.edu/archives/win2012/entries/knowledge-how/.

[4] Ibid.

[5] Ibid.

[6] Fantl also refers to it as "knowledge-that" as opposed to "knowledge-how," which would be constituted by practical knowledge. See Fantl, "Knowledge How."

[7] Jonathan Jenkins Ichikawa and Matthias Steup, "The Analysis of Knowledge," *The Stanford Encyclopedia of Philosophy* Winter 2012, ed. Edward N. Zalta, http://plato.stanford.edu/archives/win2012/entries/knowledge-analysis/.

As could be deducted, the type of knowledge *acquired* from figurative representation is not always of this latter type. As I stated previously, the analysis of knowledge in art understood as representation might reduce our very idea of art to mere figuration. Far more interesting would be, I think, to find propositional knowledge in the artistic practice.

Going back to the artworks that *have taught* me specific things (Bruegel, Hals, and the Edelheere altarpiece), I realize that all of them operate at different levels of knowledge. If the Bruegel paintings taught me about sixteenth-century fashion, it is so because they show it visually. The same goes for Hals's depiction of the *rommelpot*, which would also be overlapped with a sort of knowledge-how alongside the depiction of the instrument because it depicts how it is played. Finally, the knowledge that emerges from the Edelheere altarpiece is a personal deduction resulting from my previous knowledge of Van der Weyden's Deposition painting and a quick cross-reference of dates.

The matter becomes even more complicated if we take into account the decay of figuration in artistic practice since the late nineteenth century, as well as the emergence of the avant-garde in early twentieth century, the popularization of abstraction in the 1940s and 1950s, the development of conceptual art in the late 1960s, appropriation in the 1980s, and many other movements in the late twentieth and early twenty-first centuries. In contemporary art, works usually include several strategies, attitudes, and gestures as well as different mediums, making it almost impossible to analyze them in a purely visual/figurative way.

For instance, contemporary artist Josiah McElheny has vindicated the use of glassblowing in the production of art pieces. Glass, and more specifically glassblowing, has been *absent* from mainstream contemporary art spaces in recent decades; however, McElheny caught

international attention not only for his material choice, but also for his mastery of it and for the new aesthetic experiences that his work provokes. One can say, given this context of artistic production, that McElheny's *oeuvre* presents us with different and experimental ways of looking and appreciating the material (glass), thus acquiring some new understanding of the way glass works (in reflection, for instance), and how it can be used and manipulated. McElheny's works, however, cannot be reduced to its visual and formal characteristics, for they emerge in a very specific moment of contemporary art and offer a very specific discourse on the use of the material, reflection, aesthetic experience, workshop production, etc.

When thinking about the possibilities of creating knowledge through contemporary artistic practices, Chinese artist and activist Ai Weiwei comes to mind; he provides us with a complex example of how a cognitive inquiry can be propitiated and performed by an artist. In 2008, Ai supported and organized an investigation aiming to compile a list of students, mostly children, who died during the earthquake that hit the Chinese province of Sichuan on Monday, May 12, 2008.[8] Ai launched a public call for a "citizen's investigation" because the Chinese government had failed to provide an accurate list of the students killed by the earthquake.[9] By April 2009, he had compiled a list of nearly 5,500 students.[10] This was, however, not only a

[8] *Ai Weiwei: Never Sorry,* directed by Alison Klayman (2012), DVD.

[9] This case provides an example of an inquiry started and supported by an artist that produced specific knowledge that, for any reason, was not produced otherwise (by the Chinese government, for example).

[10] Ai Weiwei, "5.12 Supplement to the List of Student Victims (Eighty-Four) 09.04.11," Ai Weiwei (blog), last modified April 14, 2009, http://www.bullogger.com/blogs/aiww/archives/289730.aspx.

spontaneous act. Ai issued a new call for citizen's investigation in November 2010 to identify the victims of a fire that demolished a 28-floor tower block in Shanghai.[11]

In this particular case, it could be argued that Ai's actions constitute activism and not artistic production *per se*. However, as Mieke Bal and Norman Bryson point out, it has been difficult for art historians to draw the limits of artistic authorship and what the artist's *oeuvre* archive should include:[12] "if the author were the physical agent J. Bloggs, we should have to count among Bloggs's authorized works every doodle, every jotted diagram, that Bloggs left in the world."[13] In the case of Ai's citizen's investigations, it is undeniable that they could be fused into his artistic catalog because the majority of his works, produced and enunciated expressly as art, also operate as a form of activism and social critique. Ai's activism, whether materialized in a work of art or not, cannot be separated from his practice as an artist.

A final example of the cognitive possibilities in contemporary art practice is provided by the project *SEFT-1* by Mexican artists Iván Puig and Andrés Padilla Domene. The *SEFT-1*[14] project, which was carried out from 2006 to 2011, consisted of the creation of a spatialized

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[11] Malcolm Moore, "Ai Weiwei Starts New Openness Campaign," *The Telegraph,* last modified November 25, 2010, http://www.telegraph.co.uk/news/worldnews/asia/china/8159401/Ai-Weiwei-starts-new-openness-campaign.html.

[12] Mieke Bal and Norman Bryson, "Semiotics and Art History: A Discussion of Context and Senders," in *The Art of Art History,* ed. Donald Preziosi (Oxford: Oxford University Press, 2009), 253.

[13] Ibid.

[14] "SEFT" stands for Manned Railway Exploration Probe (in Spanish *Sonda de Exploración Ferroviaria Tripulada*).

[*sic*][15] vehicle that the artists used to explore the abandoned railway system in Mexico and Ecuador.[16] The aim of the project, according to Puig's statement, was to collect data from the landscapes through which the car toured, the experiences that the local people had with the probe, and objects found along the way.[17] *SEFT-1*, which has been exhibited in many Mexican and international art spaces,[18] is often displayed with the actual car (the probe), photographs, and objects, and it is commonly accompanied by a book that describes the project. This book includes several pictures, testimonies, and maps detailing the routes toured by the *SEFT-1*. The project, then, became a sort of archaeological enterprise that exposed and documented the state of abandonment and oblivion in which the once prosperous Mexican railway system exists today.

These examples show how specific knowledge can be generated as a result of an artistic practice, but they also show that the state of this "cognitive production" through art is neither generalized nor consistent; nay, they show that, in many cases, it might only be a secondary outcome that is subsumed to the aesthetic experience with the art object.

Each one of these works, as well as others created by different artists, deserves a specialized and in-depth analysis, for they entail complex entanglements of individual concerns, social issues, political demands, cultural values, and the like. I am interested, however, in those

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[15] The project consists of a *specialized* vehicle that performs a spatial research of the Mexican railway system. The creators often played with the idea that, with this project, they were performing a "space travel;" Puig usually quotes writer Jorgé Luis Borges who said that "all travel is spatial," see Iván Puig, "SEFT-1," Iván Puig's Official Website, accessed March 2013, http://www.ivanpuig.net/seft.html.

[16] Puig, "SEFT-1."

[17] Ibid.

[18] Recently this project was featured in the Eighteenth International Symposium on Electronic Art ISEA2012, in Albuquerque, NM.

artworks that are consciously presented as artifacts that contest, expose, or reframe "content" that is otherwise conceived of as just fact, information, or knowledge. These works could operate as a critical out-of-the-field lens that can provide a critical posture towards, in this case, other organized forms of knowledge production. In these lines, I am particularly interested in the relationship between contemporary artistic practice and scientific knowledge production and enunciation.

Usually scientific knowledge is transmitted in visual forms that aim to facilitate its understanding. I am going to acknowledge the historical and inherent relationship between science and visual representation, but for the purpose of this analysis, I will focus on productions that have been intended and enunciated as art pieces deliberately designed to reframe and ultimately expand on knowledge that has been generated from the scientific perspective.
I believe that some works of art, regardless of the artist's personal acquisition of knowledge, could serve as an expansion of particular knowledge that has been previously enunciated in other realms or, in an ideal way, derived strictly from the artwork itself. These types of artworks are usually contemporary productions that retake previous forms of knowledge in order to reformulate them or offer alternative cognitive perspectives to them.

I have chosen a single work of art from which I will examine the relationship between art and science and the possibilities of the former in expanding the enunciation of the latter. This work is *Eclipses for Austin*, created by Mexican artist Pablo Vargas Lugo for the Blanton Museum of Art at the University of Texas in Austin, Texas. The artwork serves as an exemplar of the relationships between art and science, for it contains knowledge that has been expressly produced from a scientific enterprise, astronomy, but at the same time is re-framed and re-

interpreted in order to generate a different experience with it. Science is here my point of departure and comparison with art for it is regarded as the main form of knowledge production.

Eclipses for Austin

During the summer of 2012, I participated in a seminar offered by the Jumex Foundation in Mexico City and taught by Úrsula Dávila-Villa, who was then interim curator for Latin American art at the Blanton Museum in Austin, Texas. The focus of the seminar was museum and gallery practices and, to this end, Dávila-Villa shared with us some of the projects in which she participated at the Blanton Museum as curator or organizer. During one of the sessions, she showed us a project that, for her, was an *exemplar* of interdepartmental participation within the University of Texas, because it involved people from the museum and from the athletic, video, music, and astronomy departments, as well as a host of volunteers for its realization. This artwork was *Eclipses for Austin*, commissioned by the Blanton Museum to Mexican artist Pablo Vargas Lugo.

The artwork was developed under the WorkSpace program, an initiative of the Blanton Museum, to create a space of experimentation for emerging and established artists both in Latin America and the United States. The curator in charge of developing this particular project was Úrsula Dávila-Villa, who personally selected the artist and worked with him on the project during a process that took more than a year to complete.

Eclipses for Austin is an artwork that recreates and simulates the next four solar eclipses that will be visible from the area of Austin, Texas. The four eclipses represented will take place in April 8, 2024; April 14, 2200; July 17, 2205; and February 25, 2343, respectively (Figures 1 and 2). Each of the four eclipses represented consisted of an *animation* created through card-stunt performances that involved nearly 200 people at UT's Darrel K. Royal Texas Memorial

Stadium. The recreations of the four solar eclipses were performed on October 6, 2009. The participants flipped yellow and black cards to recreate the image of the sun being eclipsed by the transit of the moon. The performances were videotaped and displayed at the museum on four TV screens from November 14, 2009 to February 21, 2010 (Figures 3 and 4). The display of the work also featured a news-like stand that contained several copies of a brochure entitled *Sun* (Figures 3, 5 and 15); this brochure resembles a periodical publication and served as communication of the events to the general public. For each performance, the artist worked with percussionist Eric Peterson to create a *soundtrack* for each eclipse representation in order to re-incorporate the element of temporality to the phenomenon.

The Artist: Pablo Vargas Lugo

Pablo Vargas Lugo was born in Mexico City, Mexico, in 1968, where he currently lives and works. He graduated from the National School of Plastic Arts of the National Autonomous University of Mexico (UNAM) in 1993. He has participated in solo and collective exhibitions since the early 1990s in Mexico as well as internationally. Vargas Lugo was part of the National System of Creators of Mexico from 2004 to 2007. He has been artist in residence in places like New Delhi, Stockholm, and New York, and also curated the exhibition, "The Smoked Mirror," in New Delhi, India, in 2003. His work has been part of important public collections such as the Museo de Arte de Lima in Lima, Peru; Museo Carrillo Gil, Museo Universitario de Arte Contemporáneo (MUAC), Museo de Arte Moderno, Secretaría de Relaciones Exteriores [Foreign Affairs Ministry] and Jumex Foundation in Mexico; and the Los Angeles County Museum of Art (LACMA), the Blanton Museum, and the Houston Museum of Fine Arts in the United States, among other institutions and museums.

Eclipses, stars, astronomy, music, time, and collectiveness are recurrent themes in Vargas Lugo's *oeuvre.* As is stated in the official dossier provided by LABOR gallery:

> The work of Pablo Vargas Lugo takes elements from various disciplines, such as astronomy, cartography or archaeology. Making drawings, sculptures, paintings and installations, he develops visual and conceptual games that refer to language, to measurement conventions, to millenary traditions.[19]

In *Reloj I, II* and *III* (2003) (Figure 13), for instance, Vargas Lugo created a video triptych consisting of three monitors, each displaying a digital clock that keeps time differently from the other two. For this piece, Vargas Lugo stated that he was "interested in the idea of dividing time into prime numbers, that is, numbers that can't be evenly divided by other whole numbers," and that he "wanted to contradict the idea of an eternally divisible time by creating a time that consists of regular but indivisible units."[20] As is exemplified in this work, his explorations often reflect a philosophical and ontological consideration of the possibilities of measurement, truth, observation, science, and time.

For the work *Bonampak News* (2005 to 2006) (Figure 8), Vargas Lugo created a set of newspapers containing ancient Mayan hieroglyphs, which were displayed on the floor of the gallery: "This piece establishes a paradoxical dialogue between the recent and the ancient, which is activated by the physical distance between the viewer and the piece. As in other works he has produced in recent years, Vargas Lugo strives here to create an image of time and the values we use to grasp it."[21] In *Sombras para estrellas y algunos eclipses* [Shadows for Stars and Some Eclipses] (Figures 6 and 7), from 2007 to 2008, he draws "representations of these astral

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[19] LABOR, "Pablo Vargas Lugo," (Dossier, Mexico City, 2012), 3.

[20] Rubén Gallo, "Pablo Vargas Lugo," in *BOMB* 94 (Winter, 2006), http://bombsite.com/issues/94/articles/2778.

[21] LABOR, "Pablo Vargas Lugo," 35.

phenomena onto paper and cardboard collages, using ephemeral or discarded objects to materialize millenarian celestial bodies that usually escape imagination."[22]

One of Vargas Lugo's most famous works is *Serie Fortuna* (2008) (Figure 9 and 10), in which he recreated a "cartographically precise"[23] stellar map using antique coins over a surface of felt. In this piece, Vargas Lugo played "with the idea of Fortune both in its minted form and as that which, according to astrology, is written in the stars and determines the day-to-day course of events."[24] It is worth noting that, in the placement of the coins (representing stars and galaxies), Vargas Lugo has overlapped some of them in order to create small eclipses (Figure 11); this same strategy using coins to represent solar eclipses is repeated in *Trayectoria de eclipses* [Eclipses Trajectory] (Figure 14) from 2009.

In *Eclipses for Austin*, Vargas Lugo "notes the relationship between eclipses and sporting events in terms of collective observation and ritual practice. This perceived connection led to his decision to stage his new piece in the UT Stadium, an arena that frequently serves as a site for collective identity building and communal excitement."[25] This work, then, is not the start of an exploration but the culmination of a specific inquiry regarding solar eclipses, time, collectiveness, and image creation.

Vargas Lugo's work often shows an extremely calculated work production, both intellectually and materially. When discussing his artwork *Intemperie* (2012) (Figure 12), a large

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[22] Ibid., 45.

[23] Ibid., 50.

[24] Ibid.

[25] "Pablo Vargas Lugo," e-flux.com, last modified December 4, 2009, http://www.e-flux.com/announcements/pablo-vargas-lugo/.

rug made from layers of colored sand, Leslie Castro highlighted Vargas Lugo's outstanding technical precision, which also was evident in *Eclipses for Austin* in 2009.[26] Curator Dávila-Villa confirmed Castro's commentary on Vargas Lugo's work, when she stated that he often works and thinks "as a scientist,"[27] and that he does not leave almost any element to chance.[28]

This brief survey of Vargas Lugo's work shows that he is an artist concerned with specific themes and motifs. His focus on time, stars, and eclipses demonstrates that his *oeuvre* explores our understanding of them. Works like *Serie Fortuna* (2008), and *Trayectoria de eclipses* (2009) are direct precedents of his interest in solar eclipses.

Thesis Preview

Harpagon. (À Mariane) *Ne vous offensez pas, ma belle, si je viens à vous avec des lunettes. Je sais que vos appas frappent assez les yeux, sont assez visibles d'eux-mêmes, et qu'il n'est pas besoin de lunettes pour les apercevoir; mais enfin c'est avec des lunettes qu'on observe les astres.*[29]

~Molière, *L'Avare* [*The Miser*], Scène V

My first encounter with Vargas Lugo's work coincided with my increasing interest in observations of the sky and stars. *Observation* is the key term here. For James O. Young, for instance, "art and empirical science have a common foundation: both begin with careful

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[26] Leslie Castro, "Catching Up with Pablo Vargas-Lugo," *Glasstire* (blog), last modified April 12, 2012, http://glasstire.com/2012/04/12/catching-up-with-pablo-vargas-lugo/.

[27] Úrsula Dávila-Villa, interview by C. Rodrigo Guzmán, July 2012, transcript.

[28] Ibid.

[29] "*Harpagon. (to Mariane)* Do not be offended, fair one, if I come to you with my glasses on. I know that your beauty is great enough to be seen with the naked eye; but, still, it is with glasses that we look at the stars." Molière, Tr. by Charles Heron Wall, The Project Gutenberg eBook of *The Miser*, last modified January 6, 2009, http://www.gutenberg.org/files/6923/6923-h/6923-h.htm.

observation."[30] In the excerpt from Molière's *Miser* quoted above, Harpagon refers to the way astronomers utilize lenses to observe the stars as a metaphor for also using glasses in order to observe Mariane, the young lady on whom he has laid his eyes.

In the early seventeenth century, Galileo published his *Sidereus Nuncius* [Starry Messenger] where, under the section entitled as "Stellar Observations," he shows the diagrams that he drew as a result of his observations of Jupiter's four moons, a fundamental proof on the reaffirmation of the heliocentric model of the universe. If we agree with Young, regarding observation as the *common* foundation of both science and art, why have both disciplines been so distant from each other in regard to the outcome derived from observation?

According to Chris Jenks, observation in science "drags behind it an excess baggage of ontological and epistemological assumptions,"[31] for it has shaped the understanding of the *self* and the *other* that prevails in social and cultural research, and has led to the idea of objectivity.[32] These assumptions are, I think, evident when the term is used indistinctly to signify empirical verification. Especially in astronomy, where its object of study is so distant, big, and unreachable, observation is not only the *metaphor* of the empirical practice in this field, but the actual method that is used in most astronomical research.[33] In aesthetic theory, on the other hand,

[30] James O. Young, *Art and Knowledge*, (London: Routledge, 2001), 66.

[31] Jenks, "The Centrality of the Eye in Western Culture," 5.

[32] Ibid., 3.

[33] Certainly, it is important to recognize that not all research in astronomy is done through optical telescopes; such is the case of radio astronomy.

Hegel suggested that vision is privileged over other senses for it implies a detachment from the object, hence fostering a purely theoretical (intellectual) relationship with objects.[34]

Why is observation the privileged sense and why is it so central to both art and science, yet considered so significantly different in each of the fields? One might doubt that observation is essential to contemporary artistic practice, but a closer look at some works by contemporary artists will confirm that it is still central to the field (even when it is not acknowledged). When asked, in *Cantanker Magazine*, the question, "in one word, what do you find inspiring and what challenging?" Vargas Lugo answered "Observation, Observation."[35] Probably this is also because, according to Castro's[36] and Dávilla-Villa's[37] accounts of Vargas Lugo's practice, he *thinks* and *behaves* as a scientist.

In this thesis, I will explore the possibilities of knowledge through contemporary artistic practices. Utilizing the work *Eclipses for Austin* by Vargas Lugo as my starting point, I will discover which discourses emerge from contemporary works that expand on scientific knowledge and understanding.

In Chapter 2, I start with a brief survey of different perspectives regarding the possibilities of knowledge through art, from the classical philosophical standpoints to contemporary approaches. Later, I will outline some premises and tenets that drive scientific

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[34] Craig Owens, "The Discourse of Others: Feminists and Postmodernism," In *Beyond Recognition: Representation, Power, and Culture*, ed. Craig Owens and Scott Stewart Bryson (Berkeley: University of California Press, 1992), 179.

[35] Cantanker, "Pablo Vargas Lugo," *Cantanker Magazine* 9, Future Continuous (2009), 14.

[36] Castro, "Catching Up with Pablo Vargas-Lugo."

[37] Dávila-Villa, interview.

inquiry, as well as the necessity of science to be communicated publicly and, more importantly, visually. Thus, I will highlight the role of visual communication in scientific communication. In order to understand the contribution of *Eclipses for Austin* to knowledge, I will describe the specificities of the astronomical approach to solar eclipses, since I will compare and contrast Vargas Lugo's work with the scientific account of this natural phenomenon.

Departing from this specific work of art, I attempt to understand how contemporary art addresses, questions, or contests scientific knowledge and its premises. My research questions are, then: What are contemporary artistic practices generating when they rearticulate scientific means of knowledge production and enunciation? What rhetorical discourses emerge from these practices as a response to expand on scientific knowledge?

In general, I consider contemporary artistic practices as statements, attitudes, and positions taken by the artists towards certain issues and subjects. For this analysis, I will regard Vargas Lugo's work as a rhetorical artifact created as a response to a very specific need that is constructed by the difference and divergence between artistic practice and science. Art *qua* rhetorical work can be analyzed rhetorically in order to unveil the underlying discourses that it is proposing as a way of, in this case, reformulating and expanding on scientific knowledge. In this regard, Chapter 3 details my methodology, which consists of identifying and describing the elements of *exigence*, *constraints*, and *fitting response*, following the idea of the rhetorical situation as proposed by rhetorical critic Lloyd F. Bitzer.[38]

In my analysis, I will identify the aspects of the rhetorical situation in the production and enunciation of Vargas Lugo's piece. I will consider every aspect of the work, from the

[38] Lloyd F. Bitzer, "The Rhetorical Situation," *Philosophy & Rhetoric* 1, no. 1 (Jan., 1968), 1-14.

performances, to the use of video; from the display in the gallery, to the production of the *Sun* brochure, as well as rely on other documents related to the exhibition and the artist, and on personal interviews I have conducted both with the artist and the curator Dávila-Villa.

I would like to stress the importance of specifics in my analysis of this piece, as I will compare Vargas Lugo's work with the astronomical/scientific account of solar eclipses. Astronomy and astrophysics, the specific sciences that I will collate with Vargas Lugo's practice, as Molière's Harpagon *observes*, utilize lenses to approach and visually reach the celestial bodies that inhabit the sky; however, the use of lenses could be also prejudicial to observation. As Joan Fontcuberta points out, *to speculate* derives from the Latin *speculum*[39] (mirror), which originally meant to observe the stars through the use of mirrors.[40] *To consider*, as well, has a sidereal origin for it meant, according to Fontcuberta, to observe the totality of the stars (*sidus* = star).[41] Hence, Fontcuberta suggests that an interesting paradox emerges from the very idea of observation: the dichotomy of both *considering* and *speculating* as subjective activities as opposed to *observation*, which is supposedly objective. Is it possible that the difference between art and science derives from the divergence in which observation is used? Has art devoted its practice to *speculation,* whereas science has stayed with mere *observation*?

[39] This word is the root of the Spanish *espejo*, the Catalan *espill* and the Italian *specchio.* See Joan Fontcuberta, *El beso de Judas: fotografía y verdad* (Barcelona: G. Gili, 1997), 39.

[40] Fontcuberta, *El beso de Judas*, 39.

[41] Ibid.

CHAPTER 2:

LITERATURE REVIEW

When I say that artworks have cognitive values, I mean that, like scientific hypotheses and historical narratives, artworks can provide an understanding of aspects of reality.

~James O. Young, *Art and Knowledge*[42]

What will be the shape of the new manner of understanding required by our future? I believe that artists are the harbingers of the future mentality required both by science and by the imperatives of living in our precarious times.

~Arthur Zajonc*, Light and Cognition*[43]

Knowing *the universe is* inventing the universe.

~Luc Brisson and F. Walter Meyerstein, *Inventing the Universe*[44]

Conceiving artistic practice as inquiry and the artistic object as a source of/means to achieve knowledge is a rough, nay extremely complex, enterprise. The idea of knowledge through art has been supported and contested by several theorists, philosophers, art historians, and artists throughout history. Before focusing on the specificities of Pablo Vargas Lugo's work, I will first attempt to draw a general panorama of some of the most important postures on the relationship between art and knowledge. In this first section, I will focus on the following texts: Plato's *Republic;* Aristotle's *Poetics*; Immanuel Kant's *Critique of Judgment*; and, finally, G. W. Friedrich Hegel's *Aesthetics*. Later, I will describe some general contemporary perspectives on the possibilities of knowledge through art and the conception of artistic practice as a form of inquiry. In this section, I will draw the first connections, similarities and differences, between art

[42] James O. Young, *Art and Knowledge* (London: Routledge, 2001), 23.

[43] Arthur Zajonc, "Light and Cognition," in *Goethe's Way of Science: A Phenomenology of Nature*, ed. David Seamon and Arthur Zajonc (New York: State University of New York Press, 1998), 310.

[44] Luc Brisson and F. Walter Meyerstein, *Inventing the Universe: Plato's Timaeus, the Big Bang, and the Problem of Scientific Knowledge* (Albany: State University of New York Press, 1995), 1.

and science. As I contrast and compare both disciplines, I will briefly describe the main premises of scientific knowledge and its public enunciation through visual communication. Finally, I will focus on the specific knowledge of solar eclipses as framed and enunciated by science in astronomy and astrophysics.

Classical and Historical Perspectives on Knowledge in Art

Although the cognitive component of art may be *found* (or argued) in art's different dimensions,[45] probably the oldest discussions on the matter have been so when art is conceived *qua* figurative representation. In this case, the key concept to be considered is *mimêsis,*[46] the definition of which although entailing *imitation* and *emulation/simulation*, should not be reduced merely to these.[47] Each author's personal account of how *mimêsis* operates is crucial to understand his or her position regarding the possibility of knowledge through art; however, not all authors make use of this term even when the focus of their work is indeed concerned with the relationship between the artistic object and what it *stands for*. In this sense, as will be seen, the term *representation* is often used as a synonym for *mimêsis*. In any case, I stress the importance of having an understanding of *mimêsis* beyond imitation and, certainly, broader than

[45] For instance, it could be argued that knowledge in art could be found only in the artistic object, or in the artistic practice, but not in the aesthetic experience, as Kant would suggest.

[46] Concordantly with Pappas, I will use this form of the word in order to distinguish it from the English "mimesis" and aiming to convey the complexity of its meaning in the original Greek conception. See Nickolas Pappas, "Plato's Aesthetics," *The Stanford Encyclopedia of Philosophy* (Summer 2012), ed. Edward N. Zalta, http://plato.stanford.edu/archives/sum2012/entries/plato-aesthetics/.

[47] Nickolas Pappas, "Plato's Aesthetics."

representation, such that it may signify also a re-enunciation of nature, a way of approaching reality, a mode of artistic inquiry, etc.[48]

Plato and the Copying of Ideas

The debate on whether art has any cognitive value may be traced back to the texts of Plato and Aristotle. Plato discussed the legitimacy of different types of representation in his *Republic* (outlined in books two and three and detailed in the 10th), where he rejects any benign feature in representation insofar as a form of *re-cognition* of reality. Imitation and figuration, Plato would suggest, move us away from reality. This idea departs from Plato's metaphysical philosophy of ideas and forms. He thought that the perceived world was imperfect and errant and that there was a more perfect realm inhabited by ideas and forms as eternal, unchanging, and transcendent entities.[49] In this sense, perceived objects are just imperfect *versions* of *eternal ideas*. Thus, *mimêsis* in the arts represents a moving away from the idea to give importance to the copy. Art would be, then, a representation of an already errant version of an idea. For Plato, it is the appearance of what is being represented in figuration and not its essence or its truth; the artist is then just an *imitator*.[50]

> - Then consider this very point: What does painting do in each case? Does it imitate that which is as it is, or does it imitate that which appears as it appears? Is it an imitation of appearances or of truth?
> - Of appearances.

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[48] Plato uses the word *mimêsis* also as the act of performing a mimetic representation, thus differentiating it from a *mimêma* which would be just the product (work of art) resulting from the mimetic act; in this case, *mimêsis* is also a *way of doing* and *seeing*, a performative act.

[49] Richard Kraut, "Plato," *The Stanford Encyclopedia of Philosophy* (Summer 2012), ed. Edward N. Zalta, http://plato.stanford.edu/archives/sum2012/entries/plato/.

[50] Plato, "Republic," in *Plato: Complete Works*, ed. John M. Cooper and D. S. Hutchinson (Indianapolis, IN.: Hackett, 1997), 598 a-c.

- Then imitation is far removed from the truth, for it touches only a small part of each thing and a part that is itself only an image.[51]

Plato's *mimêsis* is, apparently, indistinguishable from imitation. He would refuse, then, any possibility of knowledge through art.[52] Some later writings and critiques of Plato's aesthetics stressed the fact that the philosopher focused mostly on arguments against poetry when he referred to art. However, and following Bruce Aune, the Greek word *poiêsis* means indeed poetry as well as other forms of *creation*.[53] The above quote demonstrates that Plato also contemplated visual forms of artistic creation to support his ideas.

Catharsis as Learning in Aristotle's Poetics

Aristotle, contrary to Plato, shows himself more acquiescent about *mimêsis,* for he adjudges some legitimacy to representation. He saw imitation to be natural to humans; in fact, for him it is the medium through which one encounters reality: "first, the instinct of imitation is implanted in man from childhood, one difference between him and other animals being that he is the most imitative of living creatures, and through imitation learns his earliest lessons; and no less universal is the pleasure felt in things imitated."[54]

Regarding the arts, Aristotle finds *mimêsis* to be *selective* in terms of what it represents, thus educative, and furthermore, useful for a cognitive approach to reality.[55] This is why

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[51] Ibid.

[52] Furthermore, Plato discusses the nature of knowledge in other works, such as in the *Theaetetus,* where he premises that "knowledge is *nothing other than* perception."

[53] Bruce Aune, "Plato's Objections to Mimetic Art," last modified February 11, 1998, http://www.umass.edu/philosophy/PDF/Aune/PlatoonMimArt.pdf.

[54] Aristotle, *The Poetics of Aristotle*, trans. S. H. Butcher (Penn State Electronic Classics Series Publication, 2000), http://www2.hn.psu.edu/faculty/jmanis/aristotl/poetics.pdf, 7.

[55] Ibid., 7-9.

Aristotle's conception of drama as educative is not surprising. For Aristotle, tragedy's ultimate goal is *catharsis*, "the purification or purgation of the emotions aroused in a tragic performance."[56] Therefore, moral learning is a main purpose of artistic representation.

> Tragedy, then, is an imitation of an action that is serious, complete, and of a certain magnitude; in language embellished with each kind of artistic ornament, the several kinds being found in separate parts of the play; in the form of action, not of narrative; through pity and fear effecting the proper purgation of these emotions.[57]

Tragedy is, for Aristotle, an art of imitating (*mimetizing*) actions in order to achieve catharsis. Aristotle believed that there is something inherently cognitive in the enactment of actions that makes us perceive something from reality and, therefore, learn. When seeing the action happening, the audience *learns* broader possibilities of moral action. This is made possible only by drama, for "what has not happened we do not at once feel sure to be possible."[58] In this sense, Aristotle would stress, specific names and places in dramatic representation are not important,[59] for what is learned is the moral value of catharsis.

Kant and the Aesthetic Experience as Ultimate Goal

In the eighteenth century, after the consolidation of fine arts as we know them, Kant's philosophy had a great impact on the way art was conceived and experienced. For Kant, the artistic experience and judgment of taste are independent of any interest.[60] Artistic experience,

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[56] Christopher Shields, "Aristotle," *The Stanford Encyclopedia of Philosophy* (Summer 2012), ed. Edward N. Zalta, http://plato.stanford.edu/archives/sum2012/entries/aristotle/.

[57] Aristotle, *The Poetics of Aristotle*, 10.

[58] Ibid., 14.

[59] Ibid.

[60] Immanuel Kant, "The Critique of Judgement (excerpt)," in *The Art of Art History,* ed. Donald Preziosi (Oxford: Oxford University Press, 2009), 65.

deprived from all further interest, suggests just an experience of *delight* from the artistic encounter and, therefore, neither desire nor cognition of what it is being represented.[61] All the more so, for Kant, delight is shadowed by interest and desire when the importance of the real existence of the object represented comes to concern the viewer.[62] For him, "one must not be in the least prepossessed in favour of the real existence of the thing, but must preserve complete indifference in this respect, in order to play the part of judge in matters of taste."[63] Subtly, Kant expresses his conception of art as purely figurative and based on nature; however, as shown in the previous quote, he dismisses the possibility of *mimêsis* as means to approach the objects of representation, insofar as its status of existent/non-existent.

Kant recognizes the faculty of knowledge as the mere theoretical understanding of nature.[64] It is noticeable that Kant constrains knowledge (almost equaling it) to understanding, for he subsumes knowledge to the comprehension of the *a priori* laws of nature that prescribe cognitive laws.[65] Kant's distinction of delight from knowledge is evident when he states that the judgment of taste when confronting a work of art is not logical but rather subjective; hence, Kant discredits any cognitive value, not from representation itself, but from the artistic experience as an aesthetic event.

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[61] Ibid., 67.

[62] Ibid.

[63] Ibid., 65.

[64] Ibid., 62.

[65] Ibid.

Hegel and the Progression of Modes of Representation

At the beginning of the nineteenth century, Hegel's philosophy gave closure to the early modern stage of aesthetics and art philosophy. Although similar to Plato's concepts of ideas and forms, the singularity of Hegel's theory lies in the idea that the specific form that the *ideal* takes could be mapped historically in the development of the arts across cultures. Hence, even when Hegel does not focus on the nature of *mimêsis* itself, he is concerned historically with the relationship between form and idea and sign and content. In this sense, when experiencing a work of art, the type of relationship between form and idea that is being shown could unveil, according to Hegel, the historicity of the work of art.

The relationship between the individual form and idea is what determines the type of art that the object embodies. Hegel made this distinction in three particular forms of art: Symbolic, Classical and Romantic.[66] Hegel placed these three forms of art on a historical timeline. Symbolic art, for instance, would be *pre-art* (*Vorkunst*). In it, form and ideal are disproportionate, hence being a form of representation that has not been totally developed. Stephen Houlgate summarized Hegel's types of art this way: "It falls short of ideal beauty when it takes the form of *symbolic* art, and it goes beyond such beauty when it takes the form of *romantic* art. The form of art that is characterized by works of ideal beauty itself is *classical* art."[67]

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[66] G. W. Friedrich Hegel, "Philosophy of Fine Art," in *The Art of Art History,* ed. Donald Preziosi (Oxford: Oxford University Press, 2009), 85.

[67] Stephen Houlgate, "Hegel's Aesthetics," *The Stanford Encyclopedia of Philosophy* (Summer 2012), ed. Edward N. Zalta, http://plato.stanford.edu/archives/sum2010/entries/hegel-aesthetics/.

It is important to note, however, that for Hegel, the ultimate and essential function of art is to free the human spirit: "The point of art, therefore, is not to be 'realistic'—to imitate or mirror the contingencies of everyday life—but to show us what divine and human *freedom* look like."[68] Hegel's standpoint on knowledge, therefore, is risky to describe: on the one hand, the ideals of beauty and spirit dominate his philosophy of art but, at the same time, his approach inherently supposes that art can *unveil* certain (historical) relations regarding the operation of representation. Evidently, his historic timeline[69] is highly debatable but, at least, it acknowledges the historic production of a specific form of *mimêsis*.

I have broadly described the debate about the cognitive value in art as it has been posed throughout history by several authors and thinkers. It is worth noting that the different postures explained in this first section have very specific conceptions of the arts, and that these philosophers drew conclusions based on their general idea of what art is; hence, particular cases and non-representational art are often left aside. If there is to be a knowledge component in artistic practice, I think it should be analyzed in specific works of art, taking into account the context of each work's enunciation. A fifteenth-century Flemish painting would convey historic information to the versed art historian today, but what information was transmitted when it was produced? What inquiries or concerns did the artist fulfill with this work? What specific perception of reality did this work's audiences have when encountering it? These are elements that should not be left aside when addressing the "knowledge question" in art.[70]

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[68] Ibid.

[69] His timeline sees symbolic art as primitive followed by classical art as the perfection of representation and, finally, romantic art as the exacerbation of the last one.

[70] In this regard, for instance, Walter Benjamin's concept of *aura*, the *uniqueness* element that emanates from encountering the artwork, might be applied to those who experienced the

Finally, as previously stated, these approaches are concerned only with the figurative dimension of art, with *mimêsis*. As art, in a general sense, moved away from figuration during the past two centuries, the topic of cognition through art, as well as its (in)*equivalence* to other forms of knowledge construction (*viz.* science), should be rephrased and restated. Today, artistic practice is a form of inquiry, and artists working more and more within interdisciplinary settings (moving away from the studio) constitute a contemporary dimension on this matter that should be also considered as a *way of knowing.*

Contemporary Perspectives on Knowledge in Art

In contemporary scholarship, the topic of the knowledge possibilities in art has taken many shapes and has involved the consideration of art's different stages, from the artwork itself, to artistic practice as inquiry, to art as an educational tool, to transdisciplinary collaboration between artists and researchers, etc. However, there are more or less generalized ideas that have concerned recent scholars when thinking about art and knowledge. In this chapter, I will give a brief survey of these contemporary perspectives on the possibility of knowledge through artistic practice.

Rethinking Representation as a Way of Knowing

James O. Young, professor and chair of the Philosophy department at the University of Victoria in Victoria, BC, Canada, published *Art and Knowledge* in 2001, in which he discusses the cognitive value of art and its possibilities as a form of inquiry. This text represents one of the main books written on the matter in recent years, and it is my point of departure for surveying contemporary perspectives on art and cognition.

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artwork in the gallery. See Walter Benjamin, "The Work of Art in the Age of its Technological Reproducibility [first version]," *Grey Room* (2010), 12-14.

The first topic that Young addresses is knowledge through visual representation. Young's ideas are based on recurrent comparisons between artistic representation and the enunciation of scientific knowledge by describing the difference between what he calls semantic representations and illustrations.[71] For Young, semantic representations are true statements that rely on conventions, but these conventions are not merely linguistic:[72]

> A graph can represent, say, the growth of a city's population over time. It can do so only because certain conventions have been adopted. Without these conventions, it would not be possible to use the length of a bar on the graph to represent a city's population during a given year. Rules exist for transforming the information stored in a graph into statements.[73]

Illustrations, on the other hand, are specific and particular cases that could not become statements. For Young, in general, science conveys knowledge through semantic representations, whereas art does it via illustration. He emphasizes, however, that these are not absolute distinctions.[74] Young stresses later that art provides knowledge by focusing on particularity and specificity (as opposed to science), and that is where the cognitive value of art is possible: "Arts provide what I will call a *perspective* on objects. A perspective is a way of conceiving an object that can enhance the understanding of the object."[75]

It is important for Young to highlight the notion that the way in which art provides knowledge varies significantly from that of science. One way that art achieves this is by directing our attention to a particular perspective: "They [illustrations] can direct the attention of audience

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[71] Young, *Art and Knowledge*, 26.

[72] Ibid.

[73] Ibid., 28.

[74] Ibid., 66.

[75] Ibid., 67.

members and nudge them into a position from where they can recognize the rightness of a perspective on some object or objects."[76] Besides acknowledging that art can *teach* practical knowledge (how to perform an action), Young states that knowledge in art through representation could be propositional[77] when it shows cases as opposed to universalities, which are pursued by science:

> I believe that artworks can provide propositional knowledge. That is, they can teach us *that* something is the case. For example, in reading *Pride and Prejudice* one learns that first impressions are a poor guide to character, that it is dangerous to delight in making sport of one's acquaintances, and so on.[78]

Young suggests, also, that both art and science, by providing different approaches to knowledge, are also more or less suitable to specific issues, i.e. they cannot operate equally in conveying knowledge of the same things in the same way:

> The first point to make is that some matters are best understood by means of the arts, while others lend themselves to scientific treatment. Theories and rational demonstration are of little use in understanding matters such as the difference between sadness and grief, the forms hypocrisy can assume, and the dangers of a heartless educational system. On the other hand, illustrative demonstration is unlikely to shed much light on matters such as the causes of global warming, whether Homo sapiens is descended from Australopithecus or the emotions of celestial bodies.[79]

By the end of his book, Young discusses the cognitive value of art produced during and after the twentieth century as a result of avant-garde movements. His ideas are particularly relevant for my analysis since many premises in contemporary art can be traced and are indubitably heirs to the early twentieth-century avant-garde. Young states that avant-garde

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[76] Ibid., 88.

[77] Clearly, he is referring to the classical epistemological category of propositional knowledge (see Chapter 1).

[78] Young, *Art and Knowledge*, 95.

[79] Ibid., 96.

artworks "can contribute little to knowledge" and that given they "generally have little cognitive value, they generally have little aesthetic value"[80] as well.

After supporting the idea that heterogeneous movements (such as Dada, Cubism, Futurism, Expressionism, Pop, etc.) may be included under the category of "avant-garde style,"[81] Young's main argument against the epistemological value in these works could be summarized by his account of Warhol's Campbell's soup cans:

> A Warhol picture of a soup can is an illustrative representation of a soup can. This fact about the picture is, however, largely beside the point. The important feature of a Warhol picture of soup cans is that it is intended to represent something besides soup cans. It can only do so in conjunction with a body of discourse (that is, semantic representations).[82]

It is clear that for Young, art that relies, to any degree, on discourse and conceptual (non-representational) conventions, which he calls *discourse-dependent artworks,* have little to offer to knowledge in contrast to those works that, through representation, show that, as he says, *something is the case*.

New Relationships between Art and Science

The avant-garde, however, is the precedent of emergent relationships that artists established with other disciplines during the second half of the twentieth century. By the end of the 1960s, as Marga Bijvoet comprehensively summarized, artists were increasingly interested in exploring the inclusion of science and new technologies in their work.[83] These tendencies led

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[80] Ibid., 135.

[81] Young maintains that the avant-garde is a style because these works share specific features such as innovation and relational properties (as opposed to representational properties) between them and their precedents. See Young, *Art and Knowledge*, 137.

[82] Young, *Art and Knowledge*, 139.

[83] Marga Bijvoet, *Art as Inquiry: Toward New Collaborations Between Art, Science, and Technology* (New York: Peter Lang, 1997), 3.

theorists, art historians, and critics to continuously and systematically compare/contrast both practices (science and art) in terms of their processes, inquiries, outcomes, and mutual contributions. The debate, then, regarding the cognitive possibilities of art, away from the emphasis on figuration, obtained a whole new shape.

The intersection between art and science as well as their integration is, for Bijvoet, also a result of two main factors: the action-reaction logic that prevailed in most twentieth-century artistic movements (a heritage of the avant-garde);[84] and the transformation of scientific knowledge, its principles and concepts by the beginning of the twentieth century, which caught the attention and intellectual interest of the artists, thus making evident the influence of the scientific thought in the arts.[85]

The attitudes toward these new relationships and collaborations between art, science, and technology have been heterogeneous and even dissident, ranging from highly optimistic, like the Art and Technology Movement in the late 1960s and early 1970s,[86] to critically reluctant, like Jane Livingston's comments on LACMA's *Art and Technology Program*.[87] In any case, the interest on behalf of scholars and critics to understand these relations has been evident and numerous.

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[84] Ibid., 6.

[85] Ibid., 62-66.

[86] Bijvoet states that this movement lasted only four years, from 1968 to 1972. See Bijvoet, *Art as Inquiry*, 3.

[87] As observed by Bijvoet, in her evaluation of the program, Livingston "even expressed her doubts about the effects of longer-lasting collaborations in the future." See Bijvoet, *Art as Inquiry*, 59.

The first major issue that these art forms posited was to create a common vocabulary, previously nonexistent,[88] to be used in order to refer to them and approach them theoretically. For instance, Christiane Paul stresses the hazardous enterprise of using definitions such as *new media* or *electronic art*, and she observes that "the successful evasion of definitions is one of new media art's greatest assets and a main reason why so many artists, curators, and practitioners in general are attracted to this art form."[89] Critic, curator, and scholar Itsuo Sakane prefers and has been consistently utilizing the term *science-arts* (over *media* or *technological arts*) because it entails a broader understanding of what artists are doing when including new technologies and scientific knowledge to their work.[90]

> I have the strong feeling that we should not only include new technological artwork, but also new artforms which have been made possible by the introduction of a new "world vision." This includes knowledge gained from observing nature and the universe gained from new scientific discoveries since the last century. This is more than just the application of new scientific technology, but is based on a new way of looking at the time-space concept, a new cosmic view, and a new view of nature which is being influenced by a new scientific concept today.[91]

The Artist as Knower

Despite the specific terminology that is used by scholars and critics to label the integration between art, science, and technology, there are considerations on the matter that are commonly identified. The first one is the *equalization* between the figure of the artist and that of

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[88] Bijvoet, *Art as Inquiry*, 58.

[89] Christiane Paul, *New Media in the White Cube and Beyond: Curatorial Models for Digital Art* (Berkeley: University of California Press, 2008), 3.

[90] Itsuo Sakane, "The Historical Background of Science-Art and Its Potential Future Impact," in *Art @ Science*, ed. Christa Sommerer and Laurent Mignonneau (New York: Springer, 1997), 227.

[91] Ibid., 227-228.

the scientist/researcher, pointing out similarities between their processes, inquiries, and results and placing them in levels of knowledge production that are similar. Artists Christa Sommerer and Laurent Mignonneau summarize this idea when they state that

> Creation is no longer understood as expression of the artist's inner creativity or "ingenium" (according to Hegel) but becomes itself an intrinsically dynamic process that represents the interaction between the human observer, his/her consciousness and the evolutionary dynamic and complex image processes of the works.[92]

The shift of focus from the art object to the artistic process, which led to understanding the role of the artist as similar to that of the scientist, has been noted by scholars[93] as well as by artists as prevailing in most late-twentieth-century artistic movements. Artists, then, were conceived also as researchers. For instance, both electrical engineer Billy Klüver and artist Robert Rauschenberg,[94] by 1970, considered that artists had acquired new social and environmental responsibilities that required an interdisciplinary collaboration with scientists and technicians.[95]

The idea of the artist as researcher and as knower implies not only that he/she is an individual learning while producing the artwork but, also, that the artist generates knowledge that, through the work of art, can be inserted in the sphere of knowledge production and, hence,

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[92] Christa Sommerer and Laurent Mignonneau, "Art as a Living System," in *Art @ Science*, ed. Christa Sommerer and Laurent Mignonneau (New York: Springer, 1997), 148.

[93] For instance, in texts by Christiane Paul, Beryl Graham and Sarah Cook, and Steve Dietz.

[94] Klüver and Rauschenberg co-founded Experiments in Art and Technology (EAT) in 1967.

[95] Bijvoet, *Art as Inquiry*, 27.

be communicated. In this regard, Hilde Hein, when writing about the Exploratorium,[96] states, for instance, that

> The works that artists produce shape our apprehension of the world just as the discoveries of science do. Art helps us to see and hear and feel the world, and sometimes to conceptualize it. Artists are expert perceivers. They often show us phenomena that we have failed to note before, and reveal them with such indisputable definition that science is thereafter compelled to explore and understand them. Artists give us the world with an immediacy unobtainable by science, but no less than scientists, artists are bound by canons of testing and experimentation.[97]

Hein, later, says that the Exploratorium exhibits both works of science and art as equal, thus denying "the preeminence of one over the other or even a sharp distinction between them."[98] By the end of her analysis, describing the piece *Sun Painting* by Robert Miller,[99] created in the venue, Hein poses the question of whether Miller is an artist or a scientist.[100]

Performing a similar comparison between the artist and the scientist, Jeffrey Shaw points out that "the activity of both art and science has always been the interpretation and recreation of reality. It is an exercise of the human imagination, creating virtual realities that embody tentative structures of meaning."[101] Simon Werret even suggests that "there is nothing inherent in actions

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[96] The museum, founded by Frank and Jackie Oppenheimer in San Francisco in 1969, claims to be devoted to the arts, science, and human perception.

[97] Hilde Hein, *The Exploratorium: The Museum as Laboratory* (Washington, D.C.: Smithsonian Institution Press, 1990), 147.

[98] Ibid., 148.

[99] Ibid., 154.

[100] Hein argues that through his *Sun Painting*, Miller, who is regarded as an artist, *came up* with the theory that "light is information," thus contributing to knowledge. See Hein, *The Exploratorium*, 158.

[101] Jeffrey Shaw, "Convergence of Art, Science and Technology?" in *Art @ Science*, ed. Christa Sommerer and Laurent Mignonneau (New York: Springer, 1997), 162.

to designate them as artistic or scientific" and that "these identities come to be via a process of social negotiation, in which techniques emerge, stabilize, and may then endure as media, art or experiments."[102]

As an interesting gesture, Stephen Wilson, in the introduction to his comprehensive anthology on the intersections between art, science and technology, presents a quiz where he lists real projects, works, or activities and invites the reader "to determine which activities have been carried out by persons describing themselves as artists and which by those describing themselves as researchers."[103] By doing this, Wilson suggests that the practice of both artists and scientists are similar as they are both forms of inquiry and investigation.

Probably the best example of a contemporary[104] overlap between the arts and sciences in a single individual is Frank Malina, aeronautical engineer and painter who founded the renowned peer-reviewed journal *Leonardo* in 1968, which focuses on scholar research on the intersections between art, science and technology. *Leonardo*'s importance and impact, as well as the figure of Malina, has been constantly highlighted and pointed out as a case of success of these relations.[105]

The perspectives equating the artistic and the scientific practice, often vindicate the historical relations that both disciplines have had in order to support the argument of both being,

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[102] Simon Werret, "The Techniques of Innovation: Historical Configurations of Art, Science, and Invention from Galileo to GPS," in *Artists as Inventors, Inventors as Artists*, ed. Dieter Daniels and Barbara U. Schmidt, (Ostfildern, Germany: Hatje Cantz, 2008), 55.

[103] Stephen Wilson, *Information Arts: Intersections of Art, Science, and Technology* (Cambridge, Mass: MIT Press, 2002), 4.

[104] To overlook the figure of Leonardo Da Vinci, which has been commonly regarded as an example of the *perfect* integration of art and science. See, for instance, Wilson, *Information Arts*, 41.

[105] See, for instance, Bijvoet, *Art as Inquiry*, 77-79; and Sakane, "The Historical Background of Science-Art," 229.

not only similar, but inherently interrelated from the beginning. Wilson makes the argument that since the Paleolithic era and until the Renaissance, there is a blurry distinction between arts and science, and that the idea of both as clearly separate fields could be dated back to the end of the nineteenth century.[106]

Interesting examples of this historical vindication are, to give some examples, Siegfried Zielinski's *Deep Time of the Media*, where he describes his archaeological approach to media and media arts history, and the book *Artists as Inventors, Inventors as Artists,* edited by Dieter Daniels and Barbara U. Schmidt, in which the intricate historical relationships between art and science are drawn and highlighted, especially from the late nineteenth century to the present day. In the latter, Simon Penny, for example, focuses on new media works, which he calls *machine-artworks*, that become instruments that operate as "a device which is employed to generate an aesthetic artifact."[107] In this case, the parallelism between artist and scientist is given by conceiving the new media artwork as a form of invention[108] and, therefore, the process of producing it as a kind of experimentation. However, as Penny also states, the new media artist working in an established research setting, where he/she is in contact with other practitioners, is often a sinuous enterprise. He notes that "machine-artwork research is often guided by motivations which appear absurd by instrumental criteria,"[109] thus, disregarded by scientists and

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[106] Wilson, *Information Arts*, 40-41.

[107] Simon Penny, "Bridging Two Cultures: Towards an Interdisciplinary History of the Artist-Inventor and the Machine-Artwork," in *Artists as Inventors, Inventors as Artists*, ed. Dieter Daniels and Barbara U. Schmidt, (Ostfildern, Germany: Hatje Cantz, 2008), 149.

[108] As an example, Penny mentions Marcel Duchamp's rotoreliefs that were shown in inventors' fairs. See Penny, "Bridging Two Cultures," 151.

[109] Penny, "Bridging Two Cultures," 155.

researchers "as prototypes, as mock-ups, proofs-in-principle, strange kludges of available technologies."[110]

Artists Involved in Transdisciplinary Research Projects

The second main perspective on the contribution of art is the involvement of artists within research settings. These practices have exposed the transdisciplinary approach that these projects often require. Although *transdisciplinary* is an adjective often applied to these practices, it should be used cautiously, for it implies certain connotations that determine the way the collaboration is being (or should be) done. In a recent article by Martin Tröndle, in which he describes the costs and benefits of a transdisciplinary project within an artistic environment,[111] he observes that "the degree of integration of participating disciplines and fields can serve as a distinguishing feature between multi-, inter- and transdisciplinarity,"[112] thus stressing the complexity of the use of these terms. In general, transdisciplinary research requires going beyond the "normal conceptions of scientific disciplines," as it "tries to integrate and synthesize many different disciplinary perspectives."[113] But the main goal in transdisciplinary research is often equally shared by all the disciplines involved. In comparison, multidisciplinary research "approaches an issue from the perceptions of a range of disciplines; but each discipline works in

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[110] Ibid., 147.

[111] The study focused on the Swiss national research project *eMotion – mapping museum experience*.

[112] Martin Tröndle, "The Entanglement of Arts and Sciences: On the Transaction Costs of Transdisciplinary Research Settings," *Journal for Artistic Research* 1 (2011), http://www.researchcatalogue.net/view/?weave=9528&x=0&y=0.

[113] Gertrude Hirsch, David Bradley, Christian Pohl, Stephan Rist, and Urs Wiesmann, "Implications of Transdisciplinarity for Sustainability Research," *Ecological Economics* 60, Issue 1 (November, 2006), 119.

a self-contained manner with little cross-fertilization among disciplines, or synergy in the outcomes."[114] All these different ways of collaborating (and its many hybridizations) seem to occur in spaces dedicated to the integration of the arts, science, and technology.

According to Bijvoet, "equal collaboration" could be said to be the *flag* of the first attempts of transdisciplinary coupling between the arts and science.[115] The aim of places like Experiments in Art and Technology (EAT) or the Center for Advanced Visual Studies at MIT, was to provide a space of mutual dialogue between artists and engineers, and between artists and researchers respectively.[116] In both cases, the role that any of its participants should have had was, supposedly, to be equally important (and credited) in substance. However, the level of engagement and commitment from either side was, as expected, not always as fluid as claimed.

Artist and researcher Michael Naimark, for instance, when describing his personal experiences encountered in several research settings (MIT, Atari, Apple, etc.), highlights the differences in thinking and expectations that still exist between artists and engineers, scientists and organizational entrepreneurs, which lead to inevitable barriers in the process of achieving mutual enrichment.[117] These differences may lead to unsuccessful collaboration projects that are

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[114] Gertrude Hirsch, Susette Biber-Klemm, Walter Grossenbacher-Mansuy, Holger Hoffmann-Riem, Dominique Joye, Christian Pohl, Urs Wiesmann, and Elisabeth Zemp. "The emergence of transdisciplinarity as a form of research," in *Handbook of Transdisciplinary Research* (Dordrecth: Springer Netherlands, 2008), 24.

[115] Bijvoet, *Art as Inquiry*, 35.

[116] Ibid., 44.

[117] Michael Naimark, "Art ('and' or 'versus') Technology – Some Personal Observations," in *Art @ Science*, ed. Christa Sommerer and Laurent Mignonneau (New York: Springer, 1997), 123-132.

later disregarded. As a result, both artists and researchers may become doubtful of the benefits of such collaboration.

Tröndle outlines three main factors that occur as obstacles when these transdisciplinary connections are sought. First, "the understanding of collaboration with artists rarely goes beyond the idea of making scientific diagrams 'prettier,'" hence showing a reduced understanding of the artistic practice by scientists and academic scholars in general.[118] Secondly, "the time costs for interdisciplinary collaboration are very high, as are the communication and moderation costs."[119] And thirdly, "artists have a tendency to refuse the process of the division of labor, because they fear losing their status of artist in the art world, even though this opportunity would give them access to a socially relevant field of action which lies beyond the distinction game of the art market."[120]

Even when, as noted by Penny, transdisciplinary collaboration and participatory practice is *natural* in the sciences as well as in artistic practices such as music, dance, theater, film, etc.,[121] the collaboration between the former and the latter seem to be still inconsistent. Penny states that these new sets of collaborative practices need to have a specialized approach in order to be fully understood, for "this tradition can be fully understood neither within the terms of conventional art historical discourse nor within the terms of discourses of technological research and development."[122] They do not fall into the traditional history of art, nor do they add an equal

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[118] Tröndle, "The Entanglement of Arts and Sciences."

[119] Ibid.

[120] Ibid.

[121] Penny, "Bridging Two Cultures," 145.

[122] Ibid., 143.

input for the technological and scientific research. This little understanding of the stage and purpose of involvement has led, according to Penny, to underestimate the potentiality of these practices, thus letting them "fall between the cracks"[123] and later be disregarded.

Probably a more suitable way to understand these projects would be to conceive of them as *knowledge ecosystems*, a term borrowed from organizational management,[124] for they entail different types of relationships, goals, and interactions that vary from one project to another. As they often imply a *meta-dialogue* on the very nature of the collaboration (its significance, its meaning, and implications), they could operate as *ecologies of knowledge* because they rely on "self-consciousness" in order to get "to what is behind what they actually do and how they work."[125] In any case, the artistic projects that are developed under these schemata contest the value system and criteria of disciplines in its conventionality.

Art and Science as Divergent Forms of Inquiry

The ideal of an equally involved, equally credited collaboration, which does not seem to be the model that prevails in these projects, has led scholars to revisit a more ontological difference between the arts and the sciences as ways of knowing. This constitutes a third main perspective on the contribution of art to knowledge. These new critiques have highlighted the lack of a *common ground* between the participants of this collaboration in terms of what is the very goal of such practice. In other words, what is the purpose of the dialogue? Is it the creation

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[123] Ibid., 144.

[124] See, for instance, Charles C. Heckscher and Anne Donnellon, *The Post-Bureaucratic 0rganization* (Thousand Oaks, CA: Sage, 1994).

[125] Martin L. Davies and Marsha Meskimmon, *Breaking the Disciplines: Reconceptions in Knowledge, Art and Culture* (London: Tauris, 2004), 10.

of a new form of organized knowledge? Is it the expansion of the existing scientific/technical knowledge? Or is it just the broadening of the aesthetic possibilities of art via the use of new technologies?

In a rather philosophical tone, Paul Feyerabend states that scientists are similar to artists and artisans because they both utilize *unknown material*, Being, to shape the world and, "just as stone permits the construction of artworks vastly different in appearance, in the same way Being permits the construction of different *manifest worlds*."[126] As we shall see, there are ontological discrepancies between the two that need to be outlined in order to understand their convergence. Peter Weibel, for example, suggests that if art and science are to be compared, art should be regarded as method, and that it is there where both systems could be similar.[127] He suggests, however, that this assertion does not imply that both methods are similar in their operation but only that both art and science are methodological.[128]

There is a significant difference between artistic and scientific practices, points out Amie L. Thomasson, for science is based on a "discovery model," whose premises rely on thinking that there is a *real world* with a body of "fully determinate, mind-independent facts about which everyone may be ignorant or in error, but (some of) which the scientist seeks to discover by substantive empirical investigations."[129] Subsuming the arts under this model, Thomasson

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[126] Paul Feyerabend, "Theoreticians, Artists and Artisans," *Leonardo* (1996), 27.

[127] Peter Weibel, "The Unreasonable Effectiveness of the Methodological Convergence of Art and Science," in *Art @ Science*, ed. Christa Sommerer and Laurent Mignonneau (New York: Springer, 1997), 170.

[128] Ibid., 172.

[129] Amie L. Thomasson, "The Ontology of Art and Knowledge in Aesthetics," *The Journal of Aesthetics and Art Criticism* 63, no. 3 (2005), 221.

suggests, "leads us badly astray."[130] Instead, one can experience ontological knowledge in art, not through discovery "when by investigations into the mind-independent world," but by following

> the method of analyzing the conception embodied in the practices of those competent speakers who ground and reground reference of the term. As a result, although competent grounders of the term's reference may not have an explicit ontological view stated in formal philosophical terms, their background ontological conception of the sort of entity they are talking about is not subject to the kinds of massive error to which everyone's beliefs are subject, according to the discovery model.[131]

Thomasson, then, makes the distinction between empirical knowledge (provided by science), and ontological knowledge (which would be provided by art). She concludes by saying that ontological knowledge in the arts is achieved by the personal beliefs and practices of those who ground the use of artistic terms (painting, sculpture, novel, etc.) in their work.[132] Ontological knowledge carried out by art, then, is categorically different from its empirical, scientific counterpart.

According to this viewpoint, the question of knowledge in art, if answered positively, should include a more critical issue on what kind of knowledge art provides and how it differs from the scientific. In asking these questions, Sabine Flach and Bergit Arends state that "the comparison of artistic and scientific knowledge itself presupposes a *specific* knowledge inherent in art, and it also presumes that this knowledge is *irreducible* and *characteristic* for art, so that the genuine and productive achievements of art itself are in focus."[133] They suggest that the

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[130] Ibid.

[131] Ibid., 226.

[132] Ibid., 229.

[133] Sabine Flach and Bergit Arends, "Knowledge in the Arts," Eduardo Kac's Official Website, accessed March 2013, http://www.ekac.org/knowledge_in_the_arts.pdf.

debate should focus on the differences between both methods in order to use these differences "productively," so "this is about recognizing different ways of knowing, and about the interplay of different perspectives and forms of cognition."[134] Sarat Maharaj, on this matter, poses the same queries and contrasts the knowledge acquired from technological and scientific research to that gained from the visual arts.[135] He states that the visual arts propose a paradigm of *thinking through the visual*,[136] in which a focus on "unpacking" the discourse, "taking apart its components," and "scouring its operations" occurs.[137] Maharaj suggests the use of the term *xeno-epistemics* to refer to the specific knowledge production provided by these practices (visual arts in this case), for it operates outside what it is commonly understood as knowledge and spawns "other" kinds of knowledge that the former cannot.[138]

When scrutinizing the similarities and differences of science and art, scholars often outline the kinds of impact, influences, and cross-fertilization that occur in the intersection. Shaw recognizes that the influence of science in art is evident (in movements like Impressionism,

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[134] Ibid.

[135] Sarat Maharaj, "Know-How and No-How: Stopgap Notes on 'Method' in Visual Art as Knowledge Production," *Art and Research. A Journal of Ideas, Contexts and Methods* 2, no. 2 (2009).

[136] Ibid., 1.

[137] Ibid., 3.

[138] Ibid.

Cubism, Futurism, etc.), but that it is hazardous to make the assertion *vice versa*,[139] an observation that is shared by Wiebel as well.[140]

Wilson, who clearly shares his optimism on the mutual enrichment of the collaboration between the two agents,[141] acknowledges that there are similarities as well as differences between the work of the artist and that of the scientist. For instance, while the former "seeks aesthetic response, emotion, and intuition, and is idiosyncratic and evocative," the latter "seeks knowledge and understanding, reason, normative," and is "explanatory."[142]

After these considerations and identified differences, the role of art in the pursuit of knowledge measured against science is, then, seen as complimentary. Artists, for Wilson, "might see aspects of the problems missed by other researchers. The arts could become a place where abandoned, discredited, and unorthodox inquiries could be pursued."[143] For Wilson, other contributions of the arts to the scientific enterprise also include the interpretation of results in a different way, the moving away from functionality when designing technology, and a *different* way of communicating findings that takes into account its cultural implications.[144]

Even those who praised the similarity between art and science also identify differences and share the idea of the former as complimentary to the latter. For instance, Heine says that the input of artists could be valuable to science for "they render a representation of experience

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[139] Shaw, "Convergence of Art, Science and Technology?" 165.

[140] Weibel, "The Unreasonable Effectiveness," 169.

[141] Wilson, *Information Arts*, 36.

[142] Ibid., 18.

[143] Ibid., 37.

[144] Ibid., 37-38.

whose vindication lies in its resonance with the experience of others."[145] However, beyond the idea of art as complimentary, another epistemological function of art could be, as noted by Shaw, to undermine the previously established rigid constraints that realms like science and technology often entail.[146]

Elliot Eisner summarizes arts' contributions to knowledge in three points. First, "the arts address the qualitative nuances of situations,"[147] which means that works of art foster habits of perception and *reading* of representations. "A second contribution has to do with empathic feeling,"[148] which Eisner identifies in the *expressiveness* of the work of art. Finally, "a third contribution has to do with the provision of a fresh perspective so that our old habits of mind do not dominate our reactions with stock responses,"[149] which is indicated by art's constant invitation to reflect and look at what is being presented in a *different way*.

A similar perspective is taken by James Magrini, who believes that "the cognitive content of art is not akin to the cognitive content of the sciences," because science "tells us what life is by demonstrating its truth-claims, providing truth that is actual in nature;"[150] conversely, art "illuminates, reveals, and intimates truth perceptually, and within moments of insight, shows us

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[145] Hein, *The Exploratorium*, 147.

[146] Shaw, "Convergence of Art, Science and Technology?," 166.

[147] Elliot Eisner, "Art and Knowledge," *Handbook of the Arts in Qualitative Research* (2008), 10.

[148] Ibid., 11.

[149] Ibid.

[150] James Magrini, "On Art Education: Can Art Give us Knowledge?" *Philosophy Scholarship* (2001), http://dc.cod.edu/philosophypub/26.

what life is, and concomitantly, invites us to imagine what life might become."[151] Thus, knowledge provided by art differs from that provided by science because "art provides authentic insight into the complex existential aspects of life, e.g., the meaning of love, suffering, aging, religious insight, the essential world of nature, our moral interpersonal responsibilities."[152]

A final note on the possible contributions of an artistic perspective to scientific knowledge, which has been widely disregarded until recently, is Goethe's famous *delicate empiricism* [*Zarte Empirie*]. Goethe is regarded as a prominent poet, playwright, and philosopher, but he also produced a considerable body of scientific work.[153] His delicate empiricism is based on rigorous attention, as well as extended and direct observation and experience to create a sort of empathy, intuition, and imagination between the knower and the object.[154] This method "provided an alternative and complementary epistemology to conventional scientific practice and its underlying dualistic and rationalistic epistemology that categorically separates the observer and the observed."[155] Goethe's delicate empiricism, however, does not constitute an example of knowledge achievement through art *per se* (if we think about the artwork as the source of knowledge), but provides an interesting example of how

[151] Ibid.

[152] Ibid.

[153] David Seamon, "Goethe's Way of Science as a Phenomenology of Nature," *Janus Head* 8, no. 1 (2005), 86.

[154] Daniel C. Wahl, "'Zarte Empirie': Goethean Science as a Way of Knowing," *Janus Head* 8, no. 1 (2005), 60.

[155] Ibid., 58-59.

an artistic (individual) mind can contribute to science–-and especially to its method–-beyond an individual discipline.[156]

These perspectives show that even though contemporary ideas on the possibilities of knowledge in art have been shaped under the premise that the artist is conceived as akin to the scientist (in his/her practice, inquiries, experimentations, and methods), these comparisons are been taken cautiously, for it is also acknowledged that both practices entail different, often opposite, premises and worldviews, and they yield different outcomes as a result of their inquiry. As Adorno stated in his Aesthetic theory, "art completes knowledge with what is excluded from knowledge and thereby once again impairs its character as knowledge, its univocity."[157]

Scientific Knowledge and Enunciation

Most of the time, as noted by Maharaj, when we compare and contrast art and science, "what we lump together as 'science' is often a congeries of quite divergent activities, disciplines and domains, each with its own kit of objectives and logical procedures;"[158] however, scientific disciplines often depart from a set of assumptions that determine their practice. In this section, I will consider the premises of the knowledge conveyed by science. I will start by briefly describing the general principles of science and its social construction. As will be seen in Chapter 3, I conceive of both art and science as rhetorical acts; therefore, understanding the rhetoric of science is essential to understanding how science is operating in creating and disseminating knowledge. To this end, I will focus on the public communication of science with

[156] Interestingly enough, contemporary conceptual artist Alyce Santoro (who is well versed in science, having majored in marine biology and later obtained a degree in scientific illustration), was influenced by Goethe's idea and refers to herself as a *delicate empiricist*.

[157] Theodor W. Adorno, *Aesthetic Theory* (London: Continuum, 2004), 70.

[158] Maharaj, "Know-How and No-How," 1.

special emphasis on the relationship between scientific knowledge and visualization as I contemplate the possibility of the enhancement and enrichment of the former by the latter. Finally, by the end of this chapter, I devote a small section to the specificity of knowledge about solar eclipses and the way it is used and enunciated by astronomy and astrophysics.

Premises of Science and Social Construction of Scientific Knowledge

Despite the impact of the revolution on scientific thought that had occurred by the beginning of the twentieth century with the rise of the general theory of relativity and quantum mechanics, the organized body of knowledge production referred as *the sciences* shares specific epistemological and methodological principles that give them coherence and make them possible. Most disciplines that are considered scientific depart from the same main assumptions about the world, thus providing a more or less consensual ground of what characterizes science.

These principles are numerous, and they mainly depend on the specific science in which they are applied. However, several authors have outlined the general assumptions that characterize most of the scientific disciplines. Robert Merton, for instance, in mid-twentieth century, listed four *norms* of science: universalism, communism, disinterestedness, and organized skepticism.[159] Universalism is characterized by the generalized claim that scientific principles exceed particularities and ethnocentrisms.[160] Merton's second principle, communism, indicates that "there is a common ownership of goods in the scientific knowledge"[161] that denotes science's ideological claims of knowledge as a common and shareable good among

[159] Leslie Sklair, *Organized Knowledge: A Sociological View of Science and Technology* (St. Albans: Hart-Davis MacGibbon, 1973), 109.

[160] Ibid., 110.

[161] Ibid., 112.

humanity. The third norm, disinterestedness, is strongly related to the previous one, communism, for it implies that the knowledge pursued by science is not considered a *property* of researchers,[162] even though, as he also notes, the systems of reward and recognition in modern science present a contradiction to this claim.[163] Finally, organized skepticism has to do with "the standards in which criticism is organized, its content, its permissible boundaries, the criteria of evidence for and against scientific rules."[164]

Merton's list deals with generalized assumptions of what we may call the *ethics* of science. Nevertheless, there are other principles that rule scientific inquiry and its production of knowledge that are worth noting in order to understand the specific interests of scientific discourse. For instance, Everett Mendelsohn, when discussing the social production of scientific knowledge, constantly summarizes and refers to the main assumptions of science as three: rationalism, empiricism, and "an underlying belief in a material reality." [165] But, beyond the principles of objectivity and rationalism, and despite the operational procedure of the scientific method, I would like to focus in the following, more structured tenets (or axioms) that underlie the scientific understanding of the world and nature and which are particularly relevant to the purpose of this analysis: determinism, mechanisms, measurement, and prediction.

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[162] Ibid., 116.

[163] Ibid., 121.

[164] Ibid., 127.

[165] Everett Mendelsohn, "The Social Construction of Scientific Knowledge," in *The Social Production of Scientific Knowledge*, ed. Everett Mendelsohn, Peter Weingart, and Richard Whitley (Dordrecht, Holland: D. Reidel, 1977), 6.

The principle of determinism prescribes that "the natural laws and the way things are at time *t* determine the way things will be at later times."[166] Barry Loewer explains that in this axiom, to say that an event is *determined* means that it "logically necessitates"[167] from the previous conditions and the future outcome in order *to be*. In this way, given a specific scientific law, the event that it describes would be logically resulted, in a given time *t*, from the law. The idea of mechanisms, in this sense, is related to determinism for it assumes that events "are systems consisting of a collection of parts that interact with each other in order to produce some behavior."[168] Therefore, science, through an adequate theory, "should give an account of what mechanisms are, how they are discovered and represented, and the role that mechanisms play in scientific explanation."[169]

In order to give an account of how nature's mechanisms work, science necessitates measurement to assign numerical values to physical variables.[170] Measurement, then, is a symbolic assignment of values to what is observed in an event. This idea, however, as noted by Hasok Chang and Nancy Cartwright, carries epistemological issues such as the sole idea of

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[166] Barry Loewer, "Determinism," in *The Routledge Companion to Philosophy of Science*, ed. Stathis Psillos and Martin Curd (London: Routledge, 2008), 327.

[167] Ibid., 328.

[168] Stuart Glennan, "Mechanisms," in *The Routledge Companion to Philosophy of Science*, ed. Stathis Psillos and Martin Curd (London: Routledge, 2008), 376.

[169] Ibid.

[170] Hasok Chang and Nancy Cartwright, "Measurement," in *The Routledge Companion to Philosophy of Science*, ed. Stathis Psillos and Martin Curd (London: Routledge, 2008), 368.

quantification reduction and the problems of precision and conventions in the choice of numerical values.[171]

Prediction is an axiom that draws particular attention to the analysis with which I am concerned in this thesis. As explained by Malcolm Forster, prediction is not reduced only to explanation of future events, but it is the projection of the theory to the past, the present, or the future.[172] For instance, if it is true, based on the previous axioms, that a particular event is *determined* by laws, that these laws describe *mechanisms* that rule the event, and that *measurement* provides a symbolic understanding of it, then it is possible to *predict* the occurrence of the event in the future, as well as in the past. Solar eclipses provide a good example for, based on the mathematical formulae to trace them, we can *predict* eclipses that will take place in the future and *postdict* eclipses that happened in the past.[173] Prediction is "entailed by the theory,"[174] for it is "an objective relation between theory and evidence."[175]

There are many other principles that could be found in almost any scientific inquiry and knowledge claim;[176] however, I would like to draw attention to two additional axioms that are pertinent to this analysis, for they prevail in the way science enunciates knowledge about solar eclipses, which is the specific content that the artwork to be analyzed in this text is

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[171] Ibid., 370-372.

[172] Malcolm Forster, "Prediction," in *The Routledge Companion to Philosophy of Science*, ed. Stathis Psillos and Martin Curd (London: Routledge, 2008), 405.

[173] Ibid.

[174] Ibid.

[175] Ibid., 406.

[176] Another practical assumption is, for example, the idea of scientific knowledge as *progressive*; in other words, that it is in constant improvement and that it is cumulative.

reformulating. I treat these axioms separately from and in addition to the previous principles described above for, as previously stated, they operate more evidently in the scientific account of this astronomical phenomenon.

The first is the assumption that *knowing* a phenomenon in a scientific way requires an understanding of the mathematics behind it. An alternative formulation of the same principle could be: the ultimate laws of nature are mathematical. As described in their punctual comparison between Plato's cosmology and the Big Bang theory, Brisson and Meyerstein explain that this axiom may be traced back to Plato's *Timaeus*, where the philosopher states that the scientific *episteme* of the universe can only be reached via the mathematical understanding of it.[177] In a similar vein, contemporary scientific models of celestial bodies and their movements, according to these authors, are "reducible to some simple mathematical primordial elements, and everything happening in the universe, every time-dependent change (*kinesis*), is also reducible to simple mathematical interactions between simple mathematical elements. The result will be an ordered world, a *kosmos*."[178]

The implication of this axiom is that it creates an *ideal* (a model) of the observed universe that does not correspond to the complexity of its perceived nature. This difference between theory and sensible reality is referred to by the authors as a *hiatus irrationalis*,[179] for every scientific theory, which "can only resist falsification" but "can never be verified"[180] is a symbolic

[177] Luc Brisson and F. Walter Meyerstein, *Inventing the Universe*, 5.

[178] Ibid., 11.

[179] Ibid., 3.

[180] Ibid., 12

representation (and a reduction by extension) of the complexity of the sublunary world that "includes everything mankind is able to resolve, or analyze, into its elementary constituents."[181]

The last scientific axiom I would like to describe is the one that claims an apparent lack of *meaning* on observed prescribed natural laws. Hakan Snellman describes the development of the scientific project, whose origins he identifies with Galileo, as presupposing the idea that the data and facts explained by science have no further meaning.[182] For Snellman, the scientific account of the world is useful for its purpose, which has as its aim to gain power over nature, [183] but it fails to answer existential inquiries and questions of human transcendence for it "has too weak connections to our existential perception of meaning and purpose in our lives."[184]

The same lack of existential meaning and purpose could be said to be one of the features that enhanced the appeal of Darwin's theory of evolution because, as Alexander Rosenberg points out, for the very first time, nature appeared to have a *goal*,[185] through selectiveness, that was deprived of, and completely opposed to, previous concepts of transcendent purpose and of divine, immutable, design. In this sense, evolution theory does not only provide an explanation of the development of certain species, but also changed, at an essential level, our understanding of life's *purpose*.

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[181] Ibid., 11.

[182] Hakan Snellman, "The Scientific Project: Knowledge Without Meaning?" in *How Do We Know?: Understanding in Science and Theology*, ed. Dirk Evers, Antje Jackelén, and T. A. Smedes (London: T & T Clark, 2010), 53-55.

[183] Ibid., 53.

[184] Ibid.

[185] Alexander Rosenberg, "Biology," in *The Routledge Companion to Philosophy of Science*, ed. Stathis Psillos and Martin Curd (London: Routledge, 2008), 511-512.

Each one of these assumptions implies a specific way of understanding the world and conveying knowledge, which ultimately exposes the particular ideology and discursive agenda that permeates the sciences. However, in the last century, science has been scrutinized and criticized at its very foundations. This is what philosophers of science, like Eduardo Nicol, call its *crisis of principles*. Perhaps the most relevant idea that this *crisis* yielded, and which today is widely recognized also by scientists and science practitioners,[186] is that scientific knowledge is socially constructed; in other words, the weight that cultural, political, and social biases have in shaping any scientific inquiry is acknowledged.

Mendelsohn clarifies the basic assumption of this thesis by saying that "science is an activity of human beings acting and interacting, thus a social activity. Its knowledge, its statements, its techniques have been created by human beings and developed, nurtured, and shared among groups of human beings. Scientific knowledge is therefore fundamentally social knowledge."[187]

Important contributions to this sociological account of knowledge production are seen also in the vindication of the historical context in which scientific claims are produced. For instance, Thomas Kuhn, in his seminal book, *The Structure of Scientific Revolutions*, takes the example of the Copernican revolution to highlight, first, that it did not mean only a different understanding of the earth's movement, but that it changed completely the meaning of both ideas

[186] Mikael Stenmark, "From Modern to Postmodern Conceptions of Knowledge - Where Do We Stand Today?" in *How Do We Know?: Understanding in Science and Theology*, ed. Dirk Evers, Antje Jackelén, and T. A. Smedes (London: T & T Clark, 2010), 29-30.

[187] Mendelsohn, "The Social Construction of Scientific Knowledge," 4.

of *earth* and *motion*;[188] however, Kuhn also stressed that this revolution was possible because of contextual factors such as a generalized social pressure for calendar reforms, the medieval criticism to Aristotle, and the rise of Neo-Platonism,[189] thus *situating* Copernicus's findings within a broader sociocultural surface in which they were plausible and necessary.

Equally important to this analysis are the critiques that consider the scientific enterprise as necessarily discursive and, therefore, as neither ahistorical nor devoid of ideological interests. Toward the end of his *Archaeology of Knowledge*, Foucault devotes a section to the constitution of institutionalized science and the ideology of knowledge. Here, he states that "once constituted, a science does not take up everything that formed the discursive practice in which it appeared; nor does it dissipate the knowledge that surrounds it. Knowledge is not an epistemological site that disappears in the science that supersedes it. Science is localized in a field of knowledge and plays a role in it."[190] With this, Foucault recognized the input of science *qua* discursive organization that shapes what it is understood as knowledge. Scientific knowledge is, then, for Foucault, the constellation of elements "formed in a regular manner by a discursive practice."[191]

This consideration of science, which is also shared by authors like Hans-Georg Gadamer and Marcia Westkott, could be characterized as *constructivist* for it "adds a new focus on a discourse which sets out the prior background conditions necessary before a statement can even

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[188] Joanne Waugh and Roger Ariew, "The History of Philosophy and the Philosophy of Science," in *The Routledge Companion to Philosophy of Science*, ed. Stathis Psillos and Martin Curd (London: Routledge, 2008), 23.

[189] Thomas S. Kuhn, *The Structure of Scientific Revolutions* (Chicago: University of Chicago Press, 2012), 66-76.

[190] Michel Foucault, *The Archaeology of Knowledge* (London: Routledge, 2002), 203.

[191] Ibid., 201.

be considered."[192] Given this, the scientific claim can no longer be understood outside the historical, cultural, and social context in which it is pronounced, or without the machinery of enunciation that makes it possible as a rhetorical act.

Finally, it is worth noting that these critical views on science (scientific knowledge as socially constructed and science as discursive act) are evenly shared between both realms of science and art. For example, as I cited in the previous section, Werret insists that the determination of a practice as artistic, scientific, or experimental is merely conventional and results from a process of social negotiation.[193] He gives the example of the development of the telescope in the early seventeenth century, which, according to him, "moved constantly between spheres of playful art, science, and invention."[194] A similar feeling is perceived in Brisson and Meyerstein's comparison between Plato's *Timaeus* and the Big Bang narrative, which they identify akin in nature and assumptions but, one would argue, the former being considered as philosophical and the latter as scientific.

Rhetoric of Science and Scientific Visualization

As noted by Paul Teller, scientific claims are given, primarily, as linguistic because they need the description of theories and laws in a textual way.[195] This makes evident the idea that, above all, science needs to be communicated, that is, enunciated. This feature of science is

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[192] Linda Alcoff, "Justifying Feminist Social Science," in *Feminism & Science*, ed. Nancy Tuana (Bloomington: Indiana University Press, 1989), 92.

[193] Werret, "The Techniques of Innovation: Historical Configurations of Art, Science, and Invention from Galileo to GPS," 55.

[194] Ibid., 59.

[195] Paul Teller, "Representation in Science," in *The Routledge Companion to Philosophy of Science*, ed. Stathis Psillos and Martin Curd (London: Routledge, 2008), 435.

characterized by its assumption of commonality, which is the "the positive imperative to scientists that they should make their results public, or, more realistically, available to other scientists."[196]

Indeed, similar to other academic enterprises, science needs a machinery of specialized publications, papers, presentations, and other academic formats of enunciation that constitutes the primordial body of knowledge claims and discoveries.[197] However, scientific knowledge also necessitates the dimension of public address and other forms of enunciation that contribute equally to the social construction of its *episteme.*

If the main output of science, as Georg Frank states, is information,[198] then its communication and the public understanding of science are also central to the scientific discourse. In recent scholarship, one of the main actors in materializing scientific knowledge into a specific rhetorical enunciation, even prior to mass media, is identified in the process of visualization. This special emphasis in visuality and graphic representation is part of a broader recognition that science is not always conveyed verbally. On this matter, Jay Lemke states that "science is not done, is not communicated, through verbal language alone. It *cannot* be. The 'concepts' of science are not solely verbal concepts, thought they have verbal components. They are semiotic *hybrids*, simultaneously and essentially verbal, mathematical, visual-graphical, and

[196] Sklair, *Organized Knowledge*, 114.

[197] Ibid., 114-115.

[198] Georg Franck, "Scientific Communication--A Vanity Fair," *Science* 286, no. 5437 (1999), 53.

actional-operational."[199] The particular strategy of visual-graphical communication is relevant to this analysis, for I will focus on a piece of visual art that, to an extent, relates to models of visual representation in science.

In the context of science, visualization is often understood as the visual rendering of scientific claims and discoveries, thus an illustration. In this regard, a recent publication by Frankel and DePace[200] provides a detailed guide for scientists and engineers to create effective visual representations of data and scientific discoveries.[201] The reason behind the utilization of visuals when conveying information is supported by the idea that it *facilitates* understanding.[202] According to this perspective, visuality shows logical, extra-linguistic connections that would be meaningless through verbal communication alone.[203]

An interesting example is provided by a recent article by Sophie Nicholson-Cole where she explores the communication of the implications of climate change, where the claim is that, through visual strategies, the matter could be framed and transformed from scientific, general,

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[199] Jay Lemke, "Multiplying Meaning," in *Reading Science: Critical and Functional Perspectives on Discourses of Science*, ed. J. R. Martin and Robert Veel (London: Routledge, 1998), 87.

[200] Cornelia Dean, "Dimensions of Data, Turned Into Art That Speaks," *The New York Times*, last modified September 3, 2012, http://www.nytimes.com/2012/09/04/science/visual-strategies-transforms-data-into-art-that-speaks.html?ref=science&_r=0moc.semityn.www.

[201] A seminal publication on the matter is Edward Tufte, *The Visual Display of Quantitative Information* (Cheshire, CT: Graphics Press, 1983).

[202] An example of this function of graphic visualization is the popularization of the so-called infographics.

[203] David McCandless, "The beauty of data visualization," TED talk, filmed July, 2010, posted August, 2010, http://www.ted.com/talks/david_mccandless_the_beauty_of_data_visualization.html.

and abstract to concrete, personal, and local.[204] Her study proved that "people's perceptions and attitudes toward climate change are related to their visual imagery about the issue; strongly influenced by input from various visual media as well as personal experience."[205]

These perspectives imply the conception that visualization complements scientific inquiry and enables understanding. It is worth nothing, however, that some authors have also outlined the limitations and issues arising with visualization such as the general tendency of representations to focus on ideals, the impossibility to represent error and uncertainty, the dichotomy of global/local visualization, etc.[206]

The role of art in this relation has been subsumed to the idea of visualization as a *helper*. In her analysis of the Exploratorium, which has been cited earlier, Hein expresses that the work made by artists has served sometimes as complementary to the scientific demonstrations been exhibited, thus *facilitating* visitors' understanding of science.[207] In this case, Hein is talking about artworks that operate as illustrations of scientific theories and principles that enhance visitors' ability to grasp their complexity. Conventionally, and historically,[208] art inserted in the realm of science has been perceived this way.

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[204] Sophie Nicholson-Cole, "Representing Climate Change Futures: A Critique on the Use of Images for Visual Communication," *Computers, Environment and Urban Systems* 29, no. 3 (2005), 255-273.

[205] Ibid., 267.

[206] See Chris Johnson, "Top Scientific Visualization Research Problems," *Computer Graphics and Applications, IEEE* 24, no. 4 (2004), 13-17.

[207] Hein, *The Exploratorium*, 150.

[208] See, for instance, Tröndle, "The Entanglement of Arts and Sciences."

Visualization in science, nevertheless, is sometimes regarded also as more than the mere visual representation of scientific knowledge.[209] For instance, DeFanti, Brown and McCormick, when describing research opportunities of visualization for science and engineering, state that scientific visualization is both a tool for communication as well as for discovery and understanding, for there are scientific inquiries that are impossible to *comprehend* if they are not presented in visual forms,[210] and they focus especially on data sets that, through computer programs, are always rendered as graphics.

Even though scholars are posing these ideas just recently, the discursive input of visuality in knowledge could be seen in almost any other historical enunciation of science. In an article by Nancy Tuana, where she describes the masculine bias of biology as a tool to support and justify a supposedly female inferiority given by natural determinism, she explores historical postures on the matter that range from Aristotle to nineteenth-century biology. Many of the historical biological claims cited by Tuana are accompanied by illustrations that reinforce this masculine bias. For example, she describes the generalized idea (roughed out since Aristotle) that the male is the one who carries the *essence* of life, and that the female merely provides the *matter* to create the human being.[211] A late seventeenth-century scientific drawing, by Nicolaus Hartsoeker,[212] illustrates the appearance of a fetus contained within the head of a spermatozoon,

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[209] Perhaps the clearest example of this (i.e., a graphic visualization that, in fact, has agency on the way a science is configured) could be cartography.

[210] Thomas A. DeFanti, Maxine D. Brown, and Bruce H. McCormick, "Visualization: Expanding Scientific and Engineering Research Opportunities," *Computer* 22, no. 8 (1989): 12.

[211] Nancy Tuana, "The Weaker Seed, The Sexist Bias of Reproductive Theory," in *Feminism & Science*, ed. Nancy Tuana (Bloomington: Indiana University Press, 1989), 150-151.

[212] The illustration IV from Hartsoeker's *Essai de diotropique* from 1694.

thus consolidating *animalculism.*[213] However, as noted by Tuana, "Hartsoeker did not claim to have seen such a being, but insisted that if we could see through the skin which hides it, we might see it as he represent it in the illustration."[214] In this case, the illustration served as a theoretical tool to *know* visually what, for any reason, had not been yet observed empirically but was claimed as a fact.

Some authors, like Przemyslaw Prusinkiewicz, would claim even more agency to visualization in the configuration of scientific knowledge. Prusinkiewicz upholds that if, for the natural sciences, the main objective is the creation of models,[215] and that models need abstraction in order to be comprehensible, then the use of computer graphics visualizations would help to achieve it, and that "in this domain both precise botanical data and artistic observation play an important role."[216]

Besides computerized graphic-rendering, scientific visualization *qua* illustration may also be seen as artistic interpretation, but even in visual practices like photography, where the premise is, normally, the unbiased capture of reality, the input of visuality in adding to the enunciation of knowledge is recognized. For example, photographer and scientist researcher at MIT, Felice Frankel, has stated that she uses photography in science in order to "locate the innate beauty of the research, and to capture it with the kind of technical accuracy that can add information and

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[213] Animalculism is the idea that the essential structure of the animal or human being is carried out by the spermatozoon. See Tuana, "The Weaker Seed," 150.

[214] Tuana, "The Weaker Seed," 165.

[215] Przemyslaw Prusinkiewicz, "In Search of the Right Abstraction: The Synergy Between Art, Science, and Information Technology in the Modeling of Natural Phenomena," in *Art @ Science*, ed. Christa Sommerer and Laurent Mignonneau (New York: Springer, 1997), 60.

[216] Ibid.

generate new ways of thinking;"[217] thus, suggesting a rather more discursive and epistemic input to science through visualization.

Scientific visualization, not in the way of Hartsoeker's spermatozoon illustration, may be also a way to materialize concepts and phenomena that, otherwise, could not be reached by regular human observation. In this line, Luc Pauwels explains that when the referent of a representation is more "immaterial and abstract in nature," such as black holes or hypothetical events, visualization plays an important role on shaping our perspectives over that referent.[218] In this case, visualization is crucial as it might be the only way to *know* something that is not observable, exceeds our human visual capacities[219] or, simply, has not happened yet. But, beyond that, this also suggests that visualization acts in the formation of an image, a mental construction, of concepts and other phenomena.

In the introduction to his famous book *A Brief History of Time*, Stephen Hawking cites an episode in which a scientist is contested by a non-scientist person regarding the form of the universe: "Most people nowadays would find the picture of our universe as an infinite tower of turtles rather ridiculous. But why should we think we know better?"[220] Hawking makes use of

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[217] Felice Frankel, "Envisioning Science, A Personal Perspective," *Science* 280, no. 5370 (1998), 1698.

[218] Luc Pauwels, "A Theoretical Framework for Assessing Visual Representational Practices in Knowledge Building and Science Communications," in *Visual Cultures of Science: Rethinking Representational Practices in Knowledge Building and Science Communication*, ed. Luc Pauwels (Hanover, NH: Dartmouth College Press, 2006), 3-4.

[219] For astronomical observations, for example, the software Celestia provides computer-rendered three-dimensional images of the universe. Available at shatters.net/celestia.

[220] Stephen W. Hawking, *A Briefer History of Time* (New York: Bantam Books, 2005), 3.

this extravagant idea in order to state the point that the scientific account of the universe also provides a mental image of it, and that this image has changed throughout time.[221]

As I expressed in the introduction when discussing the issue of observation in both science and art, I drew attention to astronomy as primordially a visual enterprise. In this area of inquiry, given the dimensions of what is being studied, the enunciation of knowledge through visuality serves both to convey information about the world, the universe and the cosmos, and to configure a mental image of it. An interesting example of this was given recently when NASA's exploration spacecraft, Voyager 2, demonstrated that the *shape* of the solar system is not spherical, but dented.[222]

The contemporary *image* that we picture on our mind when thinking about the space and our solar system is primarily given by science and, I think, is an important dimension of our understanding of phenomena like solar eclipses. In the final section of this chapter, I will focus on the specificity of the scientific account of solar eclipses derived from astronomy and astrophysics.

Solar Eclipses

35. The eclipse as cosmically irrelevant, as a subjective experience, as an optical illusion.
36. A Shadow.

~Pablo Vargas Lugo, *Sun* (brochure to *Eclipses for Austin*)

The comparison between art and science as two large, unified, and solid blocks of cultural production could lead us astray for, as Weibel suggests, if we are to do so we need to be

[221] Ibid., 3-12.

[222] "Voyager 2 Proves Solar System Is Squashed," Voyager News & Archive, last modified December 10, 2007, http://voyager.jpl.nasa.gov/news/solar_system_squashed.html.

concrete on *what art* and *which type of science* are we coupling.[223] He punctually asks, "when we speak of the convergence of art and science do we mean that of mathematics and music or physics and painting or biology and sculpture or linguistics and architecture?"[224] The distinction is critical because, as he notes, the level of cross-influence and convergence is much clearer in specific sciences and specific types of art—for instance, the influence of drawing in biology and cartography, the convergence of linguistics and philosophy in late 1960s and early 1970s conceptual art, etc.[225]

In this case, the two factors in the comparison are identified as the visual arts in one hand, and astronomy on the other. So, the question arises: What do we know, specifically, about solar eclipses? Probably more important would be probably to ask *how* do we know what we know about them? The contemporary idea of partial and total solar eclipses exists somewhere between science, mysticism, religion, and subjectivity. Eclipses are the type of events that are characterized as being highly ambiguous: astrophysicists can trace with fathomless accuracy, and with the use of relatively simple mathematical geometrical formulae, the *exact* trajectory of any foreseeable eclipse; and, at the same time, the idea of the darkened sun and the daylight turned into nocturnal dark still shocks and thrills individuals, even when they (we) know what the phenomenon is all about.

In general, it could be said that there is almost no contemporary scholarship or specialized scientific research dedicated to investigating the nature of solar eclipses or, in other words, their causes and mechanisms. This is because it is commonly agreed that the phenomenon

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[223] Weibel, "The Unreasonable Effectiveness," 167.

[224] Ibid.

[225] Ibid., 169.

is fully understood: Via a process of *syzygy*[226] (alignment of three celestial bodies within a solar system), an astronomical occultation occurs in which the moon transits between the earth and the sun. Usually, scientists and educators regard this phenomenon, an event that "it is not visible from most planets,"[227] as a big coincidence: "It happens that our sun is 400 times larger than our moon but, on average, nearly 400 times farther away, so the sun and moon have nearly equal angular diameters of about 0.5°."[228] During a solar eclipse, the transit of the moon creates a shadow that consists of two parts: the penumbra and the umbra.[229] The penumbra is the moon's faint outer shadow in which partial solar eclipses could be seen. The umbra is the moon's dark inner shadow, in which total solar eclipses are experienced.[230]

There are four types of eclipses: partial, annular, total, and hybrid.[231] In the partial eclipse, the umbral shadow *misses* earth and only the penumbral traverses it. The annular eclipse occurs when the moon is too far from earth to completely cover the sun, thus a bright ring is visible around the moon. The total eclipse is experienced when the observer is placed in the

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[226] Harold P. Coyle, "Syzygy," *Access Science*, accessed March 2013, http://accessscience.com/abstract.aspx?id=757218&referURL=http%3a%2f%2faccessscience.com%2fcontent.aspx%3fid%3d757218.

[227] Michael A. Seeds, and Dana E. Backman, *Universe: Solar System, Stars, and Galaxies* (Boston: Brooks/Cole, Cengage Learning, 2012), 37.

[228] Ibid.

[229] Fred Espenak, "Solar Eclipses for Beginners," Mr. Eclipse, last modified 2009, http://www.mreclipse.com/Special/SEprimer.html.

[230] Ibid.

[231] Fred Espenak, "Five Millennium Catalog of Solar Eclipses," NASA Eclipse Website, last modified August 31, 2009, http://eclipse.gsfc.nasa.gov/SEcat5/SEcatalog.html#2.

transit of the moon's umbra and the moon seems to cover entirely the sun. Finally, hybrid eclipses occur when eclipses appear both annular and total in different sections of its path.[232]

A solar eclipse can only occur at new moon, which occurs every 29.5 days; however, eclipses do not occur every month (as could be thought) because the moon's orbit is tilted about 5 degrees to Earth's orbit around the Sun.[233] Normally, the moon passes *over* or *under* the sun (from the earth perspective). Eclipses occur only when both bodies, sun and moon, are aligned near one of the crossing points of the moon's orbit, also called *nodes*.[234] Geometrically, there are two nodes in the sky where the moon passes and solar eclipses are possible, which gives the following mathematical range of occurrence of solar eclipses:

> The sun does not have to be exactly on the node when the moon arrives there, only close enough for the moon to block some portion of the sun. This leaves a "window" of about 18.75 days before and after the sun gets to the nodes. During this 37.5-day period, the moon can cause an eclipse. Since the moon takes 29.5 days to go from new moon to new moon, this means that an eclipse of some kind is guaranteed about every six months.[235]

On average, a specific location on earth experiences a solar eclipse every 375 years;[236] however, this rate varies based on latitude. There are places, like Papua New Guinea, that experienced two total solar eclipses in less than 18 months between 1983 and 1984.[237] Solar eclipses vary, not only in type (partial, total, annular, or hybrid), but also in duration. The moon's

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[232] Ibid.

[233] Espenak, "Solar Eclipses for Beginners."

[234] Ron Hipschman, "Why Eclipses Happen," Exploratorium Solar Eclipse Website, accessed March 2013, http://www.exploratorium.edu/eclipse/why2.html.

[235] Ibid.

[236] L. Golub and Jay M. Pasachoff, *The Solar Corona* (Cambridge, MA: Cambridge University Press, 1997), 116.

[237] Ibid.

umbra, which is never bigger than 168 miles (270 km) in diameter, *sweeps* the earth surface at 1000 mph (1600 km/hr); thus, the sun cannot be totally eclipsed for more than 7.5 minutes.[238]

The explanation of the phenomenon, here briefly summarized, complies with one of the scientific axioms outlined in the previous section, which states that knowledge of a specific phenomenon is knowledge of its mathematical mechanisms and that, ultimately, any event, concept, or phenomena could be reduced to numbers. It seems clear that, in terms of scientific concern, solar eclipses are both a coincidence and also events that could be *easily* traced through mathematical geometrical formulae.

In the previous chapter, I also stressed a scientific axiom that prevails in the general attitude of science towards nature, which assumes that knowledge lies in nature deprived of meaning. Do scientific accounts of solar eclipses circumvent any meaning or symbolic association? Not entirely. However, acknowledgment of meaning is often considered extra-scientific. For example, in science, recognition of ancient perspectives about this phenomenon is usually done either in order to mark a difference between those perspectives and the perspective of the contemporary scientific enterprise or to acknowledge in their practices previous attempts at scientific observation.[239]

For example, the Goddard Space Flight Center's educational website on solar and moon eclipses dedicates a section to eclipse interpretation in different traditions and cultures. In this section, the distinction between *them* (ancient traditions) and *us* (technoscientific society) seems

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[238] Seeds and Backman, *Universe*, 37.

[239] For instance, Bhatnagar and Livingston in *Fundamentals of Solar Astronomy* (Hackensack, NJ: World Scientific, 2005), http://site.ebrary.com/id/10106566, dedicate the entire first chapter to talking about ancient solar astronomy, including solar eclipses observation. See also Felix Verbelen, "Solar Eclipses on Earth, 1001 BC to AD 2500," last modified November 2003, http://users.online.be/felixverbelen/catzeute.htm.

clear, with notable omission of contemporary popular interpretations that, even when they are not mythical or religious, are still present. After describing *those* cultures and traditions as having a more personal relationship with nature, the website states: "While science has brought us many obvious advances, giving us the power to predict and describe nature in great detail, it seems that we have lost that sense of intimacy and personal connection, the cosmic embrace that our ancestors experienced so strongly,"[240] thus suggesting that a scientific mind *requires* a systematic deprivation of meaning, interpretation, intuition, intimacy, or personal connection to the natural phenomena that it attempts to understand.

Knowledge of total and partial solar eclipses is often provided in big lists that contain past and future eclipses.[241] Apparently, eclipse tracing requires simple mathematical knowledge, and there is nothing more that scientists can state regarding this event; however, if this natural phenomenon is *commonly* understood, what, then, is knowledge of solar eclipses useful for?

In the first place, eclipse mapping methods vary and are often improved and critiqued between researchers—for example, Keith Horne's proposed method, developed in1985,[242] which was later improved by Baptista and Steiner in 1993.[243] Secondly, solar eclipses are frequently *used* to observe secondary phenomena that concern scientists, like the solar corona or gravity

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[240] "Eclipses Through Traditions and Cultures. Interpreting Eclipses," NASA, Goddard Space Flight Center Eclipse 99 Website, accessed March 2013, http://education.gsfc.nasa.gov/eclipse/pages/traditions_Interpret.html.

[241] For example, NASA's *Five Millennium Canon of Solar Eclipses*, in which every eclipse, from 2,000 BCE to 3,000 CE, is listed.

[242] Keith Horne, "Images of Accretion Discs. I-The Eclipse Mapping Method," *Monthly Notices of the Royal Astronomical Society* 213 (1985): 129-141.

[243] R. Baptista and J. E. Steiner, "Improving the Eclipse Mapping Method," *Astronomy and Astrophysics* 277 (1993), 331.

variations in earth.[244] Notable discoveries during solar eclipses include the detection of the element Helium (He) during a solar eclipse in 1868 when observing the outer atmosphere of the sun,[245] and the famous *confirmation*[246] of Einstein's relativity theory in 1919, when British photographers captured the bend of the light due to the sun's gravitational field.[247]

Scientist Jay M. Pasachoff conceives of solar eclipses as *astrophysical laboratories* in which "observations reaches spatial, temporal and spectral-resolution domains that are inaccessible from space and therefore complement satellite studies."[248] Study of the solar corona is regarded as the major astronomical observation during solar eclipses,[249] a study that includes coronal temperature and density variations and fine-scale coronal dynamics.

It is clear that, beyond the understanding of the mechanisms behind eclipses, for the scientific community, these events could serve a functional purpose, a tool, a natural laboratory both in earth as well as in space: "Solar eclipses observed from spacecraft can be useful for

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[244] Qian-shen Wang, Xin-she Yang, Chuan-zhen Wu, Hong-gang Guo, Hong-chen Liu, and Chang-chai Hua, "Precise Measurement of Gravity Variations During a Total Solar Eclipse," *arXiv preprint arXiv:1003.4947* (2010).

[245] Vern J. Ostdiek and Donald J. Bord, *Inquiry into Physics* (Boston, MA: Brooks/Cole, Cengage Learning, 2013), 136.

[246] The assertion that relativity was confirmed during the 1919 solar eclipse has been refuted as well as defended by several scientists.

[247] John Earman and Clark Glymour, "Relativity and Eclipses: The British Eclipse Expeditions of 1919 and their Predecessors," *Historical Studies in the Physical Sciences* 11, no. 1 (1980), 49-50.

[248] Jay M. Pasachoff, "Solar Eclipses as an Astrophysical Laboratory," *Nature* 459, no. 7248 (2009), 789.

[249] Ibid., 789-790.

calibrating the scattered light and intensities in the spacecraft, as well as using the advancing edge of the moon to measure the resolution of the spacecraft."[250]

Solar eclipses then, from the scientific perspective, have been seen as a spectacular coincidence in which moon and sun seem to have the same diameter as observed from earth. The event is highly predictable and reducible to various mathematical geometrical formulae, and its contemplation, deprived and distanced from any meaning and interpretation, is mainly used to observe and measure several other phenomena that are either enabled or facilitated during the lapse of a solar eclipse.

Chapter Summary

In this chapter, I have attempted to construct a solid conceptual framework to analyze Vargas Lugo's work, *Eclipses for Austin*, as an artifact that reformulates and expands on scientific knowledge of solar eclipses. First, I discussed classical philosophical perspectives on the matter of knowledge through art. I focused on Plato's idea of art as a defective imitation of nature; Aristotle's belief that moral learning*, catharsis,* as the main outcome of drama; Kant's concern with the aesthetic experience as the ultimate goal of art, thus devoid of cognition; and, finally, Hegel's categories of types of relations between form and idea that vary historically.

As modern and contemporary art moved away from figuration and implied a new conception of the role of the artist, as well as new sets of collaboration between it and other disciplines, the possibility of knowledge through art is also reformulated. In the second section of this chapter, I focused, then, on this new perspective over the issue of art and cognition. James O. Young's revision of representation provides a new dimension for understanding how *mimêsis* acts in gaining knowledge of specific cases and objects through art. Later, I detailed three main

[250] Golub and Pasachoff, *The Solar Corona*, 116.

perspectives on contemporary art and knowledge: 1) the more or less generalized idea that both art and science have methodological and practical similarities, thus *equaling* the artistic practice to that of the scientist; 2) the new roles that artists play in society, often resulting in artists working in research environments and on collaborative projects; and, finally, 3) the focus on the differences between art and science instead of on their similarities regarding inquiries and knowledge production. By the end of that section I listed specific inputs that art can *provide* to science, which include a focus on specificities rather than generalities, expressiveness, and meaning as well as critical attitudes to undermine and question scientific legitimacy and unity.

In order to understand the relationship between art and science, I then described the main premises of science and the social construction of scientific knowledge, primarily through visual communication. I stressed particular axioms (assumptions) that are relevant to my thesis, such as the assumption that natural phenomena can be understood mathematically, the lack of meaning in natural events, and the ideas of prediction, measurement, and determination among others. Finally, by the end of the chapter, I stressed the importance of focusing on the specific knowledge that is produced from astronomy and astrophysics with regard to solar eclipses. I noted that the scientific account often depicts eclipses as coincidental events, and that interest in solar eclipses usually entails experiments and research on other natural phenomena (solar corona, earth gravitation, relativity, and the like).

The following chapter is devoted to describing the methodology that I will follow in my analysis of *Eclipses for Austin*. I will describe how I conceive of both scientific and artistic practices as rhetorical acts, and I will describe the research questions that I will try to answer after the analysis. A more detailed description of the artwork is also given in the following chapter.

CHAPTER 3:

METHOD

In this thesis, I will analyze *Eclipses for Austin*, an art installation by Pablo Vargas Lugo, and its relationship to scientific knowledge and enunciation. I conceive of the work of art as a rhetorical artifact that is a response to a specific situation, thus generating rhetorical discourses to address that situation that can be described and analyzed. Contemporary art has been, far from the focus on form and mastery of a medium, a tool that artists use for communication, enunciation, and materialization of specific ideas—be they related to the social apparatus, individual transcendence, philosophical perspectives, etc. Art is a statement. Art conceived of as a discursive artifact requires rhetorical approaches in order to understand its operation within a specific discursive frame.

As stated in previous chapters, I will analyze the rhetorical discourses that emerge from Vargas Lugo's work as a response to expand on scientific knowledge and enunciation; in order to achieve this, I will perform a rhetorical analysis of the piece. This chapter is, therefore, devoted to my research questions as well as to the methodological framework to be used. I depart from the assumption that the artist is consciously and expressly using knowledge of solar eclipses obtained from scientific enunciation as a theme in his artwork, thus, I will focus on the visual and discursive elements that he utilizes to create bridges or connections between the scientific and the artistic. To this end, I will primarily use the idea of the *rhetorical situation* as proposed by critic Lloyd F. Bitzer as my theoretical and methodological framework. For the data itself, I will rely on *Eclipses for Austin* as well as on personal interviews I conducted with both the artist himself and curator Úrsula Dávila-Villa. In the following sections I will proceed to describe Bitzer's rhetorical situation as well as detailing the elements of the artifact.

Research Questions

To understand Vargas Lugo's *Eclipses for Austin* as a contemporary art piece that draws from and contributes to our understanding of scientific knowledge, I pose the following research questions: What are contemporary artistic practices generating when they rearticulate scientific means of knowledge production and enunciation? What rhetorical discourses emerge from these practices as a response to expand on scientific knowledge?

I depart from the idea that both art and science require a specific enunciation in which their specific discourses are embedded. In classical rhetoric, enunciation is often regarded as the speech utterance that combines pronunciation and articulation.[251] In this case, however, scientific and artistic enunciations are understood in terms of how their discourses are *coming into being* as rhetorical acts, in other words, when they are communicated. Therefore, my research questions are focused on exploring the actual communication (articulation and utterance) of scientific knowledge that is carried out by the artwork.

Rhetorical Situation

Given that I am not an art historian myself, I will treat the production of a work of art as a rhetorical act. I am aware that art (and especially contemporary art) could be approached from different and even oppositional methodological frameworks, such as semiotics, formalism, style, historicity, and visual culture, to name a few. Rhetorical theory, on the other hand, is historically attached to speech and language. However, contemporary rhetorical criticism often allows a broader spectrum of artifacts to be analyzed. In many cases, productions from visual culture and works of art constitute these artifacts. In this sense, I consider it appropriate to treat works of art

[251] See, for example, R. T. Linnington, *The Rhetorical Speaker; and Poetical Class Book* (London: J. Souter, 1833).

as discursive artifacts that, when examined, reveal critical attitudes and issues posed by the artists that create them. Citing critic Kenneth Burke, I agree that "when an art object engages our attention, by the sheer nature of the case we are involved in at least as much of a communicative relationship as prevails between a pitchman and a prospective consumer."[252]

I would like to stress, however, that visual works conceived as rhetorical artifacts should not be reduced to their formal elements as being the particles of the discourse, i.e. motifs, colors, figures, metaphors, etc. I think that contemporary art requires a broader understanding of rhetorical elements based on the complexity of the artworks. In many cases, contemporary works of art include gestures, performances, and actions that cannot be reduced to visuality but that function as entangled statements or *attitudes*, even when the result is indeed rendered as a visual image or artwork. For example, the image of the green fluorescent bunny,[253] unquestionably the flag of bio-art, embeds far more discourses than just the fact that the animal glows due to the effect of the green fluorescent protein (GFP). This is why I utilize Lloyd F. Bitzer's concept of the rhetorical situation as a way to understand how contemporary art is operating, since it allows us to reach deeper, often abstract (non-visible) levels of discourse layered within contemporary art pieces.

According to Bitzer, meaning emerges from a given situation, and "no utterance is fully intelligible unless meaning-context and utterance are understood."[254] This means that a rhetorical

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[252] Kenneth Burke, "On Form," *Hudson Review* 17, no. 1 (Spring, 1964), 106.

[253] The work is *GFP Bunny* by artist Eduardo Kac. The picture of Alba, "the fluorescent bunny," was taken by Chrystelle Fontaine and, according to professor Dr. Hervé-Pierre Lambert, was later modified digitally to give the bunny the characteristic glow. The project, as stated by Kac himself "is a complex social event," far beyond the mere image of the green bunny.

[254] Lloyd F. Bitzer, "The Rhetorical Situation," *Philosophy & Rhetoric* 1, no. 1 (Jan., 1968), 3.

artifact needs to be understood in relationship to the factors that contribute to its production. The rhetorical situation, for Bitzer, is not merely the understanding of the setting in which a discourse takes place (the physical space, context, the audience, etc.),[255] nor is it reduced to the persuasive situation;[256] rather, the situation is the circumstance by which an artifact comes to being. For Bitzer, rhetorical works (i.e., artifacts) emerge as a response to a very specific situation.

> A tree does not obtain its character-as-tree from the soil, but rhetorical discourse, I shall argue, does obtain its character-as-rhetorical from the situation which generates it. Rhetorical works belong to the class of things which obtain their character from the circumstances of the historic context in which they occur. A rhetorical work is analogous to a moral action rather than to a tree. An act is moral because it is an act performed in a situation of a certain kind; similarly, a work is rhetorical because it is a response to a situation of a certain kind.[257]

To better understand Bitzer's rhetorical situation, we must think of rhetorical works as *pragmatic*, that is, they exist for the sake of performing some specific task.[258] The need for which the rhetorical act responds is called the *exigence.* The exigence, as explained by Bitzer, is "an imperfection marked by urgency; it is a defect, an obstacle, something waiting to be done, a thing which is other than it should be."[259] Hence, the rhetorical exigence is the necessity that the rhetorical work is addressing. The first step in my analysis of Vargas Lugo's piece will be, then, to identify the exigence to which he is responding through his artwork.

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[255] Ibid.

[256] Ibid.

[257] Ibid.

[258] Ibid., 4.

[259] Ibid., 6.

As Foss and Foss point out, Bitzer's rhetorical situation comprises three additional elements: the constraints, the audience, and the fitting response.[260] For this analysis, I am particularly interested in rhetorical constraints, which are constituted by those elements (persons, events, objects) that have the power to change the exigence,[261] as well as the fitting response. The constraints in the rhetorical situation are opportunities and limitations that the rhetor confronts and manages with the rhetorical work to respond to the exigence and provoke change.[262] The second stage of my analysis will be devoted to identify and describe these constraints from which the artwork is coming to exist.

Bitzer specifies that there are two types of constraints, those originated and managed by the rhetor and those that are *operative* and do not depend on the former.[263] For him, "beliefs, attitudes, documents, facts, traditions, images, interests, motives and the like"[264] characterize typical forms of operative constraints.

The next step in my analysis, which will constitute the majority of my discussion in this thesis, will be to describe the discourses that emerge from the artwork and that address the exigence that has arisen as a result of the operative constraints. These discourses constitute what Bitzer identifies as the *fitting response*. For him, "discourse is rhetorical insofar as it functions

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[260] Sonja K. Foss and Karen A. Foss, "Our Journey to Repowered Feminism: Expanding the Feminist Toolbox," *Women's Studies in Communication* 32, no. 1 (Spring, 2009), 37.

[261] Ibid.

[262] Ibid.

[263] Bitzer, "The Rhetorical Situation," 8.

[264] Ibid.

(or seeks to function) as a fitting response to a situation which needs and invites it."[265] When a rhetorical situation has been established, the rhetorical work (the artifact), as I have explained, works as the response to this situation, *the fitting response*. Bitzer explains that, "although rhetorical situation invites response, it obviously does not invite just any response. Thus the second characteristic of rhetorical situation is that it invites a *fitting* response, a response that fits the situation."[266] This response, as I had stated, is what will constitute the centrality of my thesis and the majority of my findings.

Since its formulation in 1968, Bitzer's concept of the rhetorical situation has been widely accepted, as well as contested and questioned. Barbara A. Biesecker, for instance, critiqued the idea that the rhetorical situation apparently implies that the audience is constituted by consummate individuals, thus limiting the discourse's persuasive capabilities.[267] Notable is also Richard E. Vatz's article "The Myth of the Rhetorical Situation," where he points out Bitzer's Platonist *Weltanschauung*[268] in which he considers, rhetors, objects, and relations to be objective and present in reality, prior to the rhetorical event.[269] Despite the criticisms and elaborations of Bitzer's model, it still can be used as a general scheme to approach and analyze an artifact because it offers an understanding of the actors and discourses involved in a rhetorical act. This

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[265] Ibid., 6.

[266] Ibid., 10.

[267] Barbara A. Biesecker, "Rethinking the Rhetorical Situation from within the Thematic of 'Différance'," *Philosophy & Rhetoric* 22, no. 2 (1989), 111.

[268] Richard E. Vatz, "The Myth of the Rhetorical Situation," *Philosophy & Rhetoric* 6, no. 3 (Summer, 1973), 155.

[269]Ibid.

is the way I am utilizing rhetorical situation to understand the meaning that emerges from Vargas Lugo's piece.

As I stated previously, *Eclipses for Austin* expressly introduces scientific knowledge in the discursive content of the artwork, literally *citing* a specific system of organized knowledge (i.e., science). Why is the artist doing this and what is his purpose? In order to answer this question that, ultimately, will help me answer my research questions, an understanding of a work of art through its rhetorical elements is necessary. It is indispensable to identify the exigence that the artist is *fulfilling* as well as the set of relationships he is creating between the artistic and the scientific, the objective knowledge and the mystic personal experience, the general and the particular, etc. In summary, my methodology will be focused on the following three levels of analysis: a) I will identify and describe the *exigence* to which the artwork is a response; b) I will identify and describe the *operative constraints* from which the artwork is coming into being as a rhetorical artifact; and, finally, c) I will identify and describe the discourses that emerge from the work that address the exigence and that constitute the *fitting response* to the rhetorical situation.

Approaching Contemporary Art through Rhetorical Criticism

Contemporary art, as I stated in Chapter 2, is not so different from a verbal statement; hence, it could be conceived of as a rhetorical act. Although for the purpose of this analysis I will not focus on audience response, it is departing from this specific concept that Bitzer elaborates his conception of science and art and their (im)possibility to be rhetorical. The audience, for him, is the group of individuals able to be changed by the rhetorical work.[270] However, when elaborating on this concept, Bitzer comments that "neither scientific nor poetic discourse

[270] Foss and Foss, "Our Journey to Repowered Feminism: Expanding the Feminist Toolbox," 37.

requires an audience in the same sense"[271] as a rhetorical discourse does. He argues that, although both discourses have an audience in the strict sense, the scientist "can produce a discourse expressive or generative of knowledge without engaging another mind,"[272] whereas "the poet's creative purpose is accomplished when the work is composed."[273] It is clear that for Bitzer, the discursive production of both science and art can exist alone, without a rhetorical enunciation and without requiring a rhetorical audience. For him, conversely to the scientific and poetic audiences, the rhetorical audience "must be capable of serving as mediator of the change which the discourse functions to produce."[274] Later in my analysis I will expand on this idea and argue that both science and art are rhetorical practices because they require an enunciation in order to be communicated as well as an audience that *changes* (gains knowledge or has an aesthetic response) after experiencing it.

In order to scrutinize this idea of the rhetorical audience, I found Richard L. Larson's comment on Bitzer's rhetorical situation very helpful. Larson points out an apparently problematic issue that the rhetorical situation suggests regarding the division of actions into rhetorical and non-rhetorical categories.[275] Larson suggests that, for Bitzer, an action is rhetorical for it is a response to a specific situation, and that the designation of *rhetorical* should be reserved exclusively for discourse generated in circumstances that have the characteristics stated

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[271] Bitzer, "The Rhetorical Situation," 8.

[272] Ibid.

[273] Ibid.

[274] Ibid.

[275] Richard L. Larson, "Lloyd Bitzer's 'Rhetorical Situation' and the Classification of Discourse: Problems and Implications," *Philosophy & Rhetoric* 3, no. 3 (Summer, 1970), 165.

by Bitzer (exigence, audience, constraints and fitting response).[276] These requirements immediately yield a set of categories regarding the rhetorical and the non-rhetorical. Larson suggests, then, that it could be possible to think of a third category constituted by discourse that "was thought to be rhetorical when produced, but is not truly so because (as events turn out) it could not have modified the exigence."[277] Using the same logic, one could think that a new (fourth?) category could be constituted by such discourses that might have not been produced as rhetorical *per se*, at least not expressly, but that when enunciated, address the exigence and provide a fitting response. As I will later explain in further chapters, this issue arises from the idea that a rhetorical act is so because it is intended in this way since its conception. Even though, as discussed previously, Bitzer did not think of the poetic discourse as necessarily rhetorical, the personal intention of the artist as rhetor plays an important role in the artistic discourse.

Contemporary rhetorical criticism offers a broader possibility to analyze different discursive acts through a rhetorical methodology. Sonja Foss, for instance, stresses the importance of studying the visual as part of the rhetorical environment: "Visual artifacts constitute a major part of the rhetorical environment, and to ignore them to focus only on verbal discourse means we understand only a miniscule portion of the symbols that affect us daily."[278] Although, as I have argued, contemporary art cannot be reduced solely to visuality,

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[276] Ibid.

[277] Ibid.

[278] Sonja K. Foss, "Framing the Study of Visual Rhetoric: Toward a Transformation of Rhetorical Theory," in *Defining Visual Rhetorics*, ed. Charles A. Hill and Marguerite H. Helmers (Mahwah, NJ: Lawrence Erlbaum, 2004), 303.

understanding the visual as rhetorical is crucial to approaching art rhetorically since it is usually rendered in visual forms.

Even when a specific artwork's purpose is not figurative representation, it still requires spectatorship of some kind. In this sense, the art piece is a *window* or a *portal* through which the viewer enters into the artist's perspective of the world.[279] This event, which is nothing else but the aesthetic experience, is highly rhetorical for, as Marguerite Helmers explains, "viewing is a transaction enacted within a cultural moment."[280] Thus, this experience generates a rhetorical situation in which, according to Foss and Radich's model to understand aesthetic response, first a *special reality* is created by the art object, secondly, the audience visualizes this special reality and, finally, there "is an identification between artist and viewer that enables the visualization to occur."[281]

Rhetorical criticism applied to contemporary art, as opposed to an art historical approach, offers an analysis that departs from the non-specialized viewer's experience. Helmers explains that this perspective offers an analysis that is more akin to a postmodern conception of reality, because it focuses on the affects and the experience at the moment of enunciation,[282] thus circumventing the necessity of art history to link the artistic production to an artistic movement,

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[279] Sonja K. Foss and Anthony J. Radich, "The Aesthetic Response to Nonrepresentational Art: A Suggested Model," *Review of Research in Visual Arts Education* (1980), 42.

[280] Marguerite Helmers, "Framing the Fine Arts Through Rhetoric," in *Defining Visual Rhetorics*, ed. Charles A. Hill and Marguerite H. Helmers (Mahwah, NJ: Lawrence Erlbaum, 2004), 68.

[281] Foss and Radich, "The Aesthetic Response to Nonrepresentational Art: A Suggested Model," 40.

[282] Marguerite Helmers "Painting as Rhetorical Performance: Joseph Wright's *An Experiment on a Bird in the Air Pump*," *JAC* 21, no. 1 (2001), 72.

trend, or period specifically. In this sense, rhetorical criticism would focus neither on the aesthetic experience with the artwork nor its *aura*,[283] but its enunciation as a discursive artifact (performatic or mechanically reproduced).

Finally, as Helmers explains, the artist is the decision maker when producing the work of art;[284] therefore, he or she fits the idea of the *rhetor*. In this regard, Scott Consigny, when discussing Bitzer's rhetorical situation, explains that the concept of *rhetor* in Bitzer's rhetoric might be ambiguous for it "does not possess a special capacity which distinguishes him from other problem-solving experts."[285] An artist, then, given a specific rhetorical situation, could be Bitzer's rhetor, because "if the rhetor is to function effectively in novel rhetorical situations, disclosing relevant issues in each, he requires a capacity which allows him to be receptive and responsive to the particularities of novel contexts."[286] In my analysis, I will identify Vargas Lugo as this rhetor who addresses the *exigence* in novel and creative ways.

The Artifact (Data)

As described in the introduction, *Eclipses for Austin* contains several elements that enrich and enable a broader analysis of it as a work of art. In brief, the work consists of a card-stunt performance[287] at UT's Darrel K. Royal Texas Memorial Stadium, a performance (Figure 1 and

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[283] See Walter Benjamin, "The Work of Art in the Age of its Technological Reproducibility [first version]." *Grey Room* (2010), 11-37.

[284] Helmers, "Framing the Fine Arts Through Rhetoric," 68.

[285] Scott Consigny, "Rhetoric and its Situations," *Philosophy & Rhetoric* 7, no. 3 (1974), 180.

[286] Ibid.

[287] A performance in which participants flip medium-scale (often single-color-per-side) cards in unison to create an image collectively.

2) that was videotaped and displayed at the Blanton Museum's gallery on four television screens (Figure 4). The performance was accompanied by a news-like stand containing the brochure, *Sun*, which resembles a periodical publication.

The reenactment of the sun being eclipsed is the first meaningful rhetorical element. The artist chose to recreate the eclipsing sun using a collective/massive visual production (card stunts, which are mainly used in sports and patriotic events). However, the artwork is not the performances of the solar eclipses themselves, for they were not meant to be displayed as performative events in front of an audience; rather, the artist decided to create four different videos of these events, which would be displayed later in the gallery. This gesture constitutes a second element of analysis, for it indicates the artist's interest to produce a testimony to these events, rather than a mere reproduction of them.

In these videos, Vargas Lugo worked with percussionist Eric Peterson to create a *soundtrack* for each solar eclipse representation. I will not focus on the formal elements of the musical composition, but rather on the act of adding temporality to each event as a rhetorical element that serves a specific purpose. The time feature of eclipses is highlighted by the music for it shows how every eclipse has a particular duration, thus contrasting with the scientific idea of describing eclipses in a general way, focusing on the main causes and the general features of the phenomenon, and not on particularities.

In the gallery, the work was displayed on four television screens, each presenting one of the representations. The display was accompanied by a stand with the *Sun* brochure, containing several elements that communicate the idea of the work to the general public (Figure 3 and 5). Beyond the display (which I will also count as an element of importance in the enunciation of the work), I will also treat the content of the *Sun* brochure as meaningful data for my analysis. This

brochure, resembling the layout of a newspaper or periodical publication, contains the following elements:

- A chart indicating the solar eclipses that will be visible from the Austin area in Texas between years 2010 and 3000.
- Two artistic illustrations of shadows covering a map representing the Texan territory and the UT's stadium.
- Visual representations of the four eclipses reenacted in the work, viz. April 8, 2024; April 14, 2200; July 17, 2205; and February 25, 2343.
- Text by curator Úrsula Dávila-Villa.
- Several pictures of the performance.
- Testimonial text, followed by a series of photographs, by a participant of the performance.
- An interview with Pablo Vargas Lugo.

These elements constitute the main data to be analyzed in this thesis. However, I will also rely on other data that I acquired regarding the piece, viz. the artist's official statement, the original project description, the Museum's press release, the gallery label for the work, a flyer for the project, the seating chart for the performance, and other unofficial documents provided by the artist and the curator. Finally, I will also use personal interviews that I conducted with both the artist and the curator Úrsula Dávila-Villa as part of my data.

Interviews

Curator Úrsula Dávila-Villa introduced me to the artist, Pablo Vargas Lugo in Mexico City during the summer of 2012. After I met with Vargas Lugo, I had a better understanding of

his specific concerns and inquiries as an artist as well as a deeper grasp of his overall ideas in *Eclipses for Austin*.

In a way, artists are akin to academic scholars and researchers for they have specialized themes and topics of concern to them and in which they base their practice. In the case of Pablo Vargas Lugo, eclipses, astronomy, time, and collectiveness are recurrent themes or motifs, which he has included in several pieces, such as *Reloj* (2003), *Moon Impression* (2005), *Ciclo lunar* (2006), *Bonampak News* (2005-06), *Sombras para estrellas y algunos eclipses* (2007-08), *Serie Fortuna* (2008), and *Trayectoria de eclipses* (2009), among others.

My meeting with Vargas Lugo shed light on several underlying elements of the piece that I think are important in order to perform a more accurate rhetorical analysis of the artwork. In most contemporary art pieces, an understanding of the artist's decisions are crucial to untangle the ideas that they are attempting to convey through their pieces. The artist/rhetor's ideas and explanations of his/her own work are therefore central to the rhetorical analysis.

Úrsula Dávila-Villa, on the other hand, was the curator in charge of the project *Eclipses for Austin*. As mentioned before, this project emerged as part of the WorkSpace program created by the Blanton Museum in the University of Texas in Austin. The role of the curator is also crucial in contemporary artistic production. In this case, not only the selection of the artist was Dávila-Villa's decision but, primarily, the development of the project was a product of the dialogue and exchange between the artist and the curator and, to this end, the Blanton Museum was the facility that served as a *space for experimentation*, in Dávila-Villa's words.

My interviews with the artist and curator broadened my perspective of this artwork. I find it important to talk about the relationship between curators and artists as a specific form of artistic production, which prevails in many contemporary art spaces. It is this idea of

transdisciplinary collaboration that I also credit as central to Vargas Lugo's piece for it included the involvement of several people from different backgrounds and practices to its production.

In the following chapters, I will present my findings and analyses, which are the different discourses that the artwork presents as responses to the rhetorical situation. I will describe the operation of these discourses in rearticulating and expanding scientific knowledge.

CHAPTER 4:

ANALYSIS AND FINDINGS

Art completes knowledge with what is excluded from knowledge and thereby once again impairs its character as knowledge, its univocity.

~Theodor Adorno, *Aesthetic Theory*[288]

Solar eclipses are not astronomical events, they occur here in Earth.

~Pablo Vargas Lugo[289]

For this current chapter, I will identify and describe the way *Eclipses for Austin* is operating in order to expand on the scientific knowledge of total solar eclipses. I will utilize Bitzer's idea of the rhetorical situation, as well as its concepts of *exigence*, *constraints* and the *fitting response*, as my methodological framework to perform this analysis. First, I will identify and describe the *exigence* or need to which the work serves as a rhetorical response. Then I will identify and describe the different *constraints* that operate both in contemporary art, as well as in scientific inquiry, by which the artwork comes into being. After, I will describe and discuss the specific strategies of appropriation and rearticulation, which are used by Vargas Lugo in order to respond to the situation and satisfy the exigence. Finally, I will describe the specific discourses that emerge from the work of art and which I have identified as the *fitting response* in this rhetorical situation; they comprise five discourses to which the work of art draws attention: 1) total solar eclipses as collective events; 2) the focus on location and particularity of the phenomenon; 3) the attention to the duration of each eclipse; 4) the emphasis on the *memory of the future*; and, lastly, 5) the deprived mystic symbolism that, in general, prevails in our contemporary experience of total solar eclipses.

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[288] Theodor W. Adorno, *Aesthetic Theory* (London: Continuum, 2004), 70.

[289] Pablo Vargas Lugo, interview by C. Rodrigo Guzmán, August 2012, interview A, transcript.

Exigence

It becomes difficult, as described in the previous chapters, to approach art from a rhetorical perspective since rhetoric has been historically related to speech and public address, whereas art has been, in general terms, related to personal interpretation and subjectivism. Nonetheless, in previous chapters, I have laid out several examples of how art can be approached from a rhetorical perspective. Contemporary art, as well as contemporary rhetorical criticism, offers a broader range of perspectives for analysis (philosophy, psychoanalysis, formalism, rhetoric, etc.), thus allowing us to frame art as a rhetorical artifact. Often, art is not conceived of as rhetorical for its message and its address seem not entirely intelligible. Apparently, the spoken and the written word provide a *clearer* message, thus a more solid ground to perform a rhetorical analysis. In Larson's critique of Bitzer's rhetorical situation,[290] he highlights the apparent hermetic nature of Bitzer's designation of *rhetorical*. As I have suggested earlier, Bitzer perceives of both artistic and scientific discourses as operating in a different, almost non-rhetorical way[291] since, for him, a rhetorical act would be that in which all the elements of the rhetorical situation (exigence, audience, constraints and fitting response) are present. Larson explains that this distinction produces, on the one hand, a set of two categories of rhetorical and non-rhetorical; but he proposes a third category in which a rhetorical action is disabled by the

[290] Richard L. Larson, "Lloyd Bitzer's 'Rhetorical Situation' and the Classification of Discourse: Problems and Implications," *Philosophy & Rhetoric* 3, no. 3 (Summer, 1970).

[291] Bitzer suggests that both scientific and artistic discourses are consummated with their respective productions (knowledge and work of art), thus not requiring a specific audience in the same sense of a rhetorical act. See Lloyd F. Bitzer, "The Rhetorical Situation," *Philosophy & Rhetoric* 1, no. 1 (Jan., 1968), 8.

failure to address and respond to the exigence.[292] In my previous chapter, I explained that, following Larson's logic, a new fourth category could comprise those acts that are not expressly enunciated as rhetoric but that, under a proper analysis, might be read as rhetorical for they *meet* all the features of the rhetorical situation as proposed by Bitzer and address the exigence. I understand Vargas Lugo's *Eclipses for Austin* as a rhetorical event since it addresses a specific exigence, is limited by several operative constraints, and more importantly, produces discourses that respond to that exigence.

The first purpose of this analysis is, therefore, to identify the exigence to which the work of art is responding. The exigence is often conceived of as a *need*, a necessity that requires the rhetor to elaborate a response through his or her rhetorical work. The exigence could be constituted by almost anything, from a persuasive goal to the importance of highlighting a social issue, for instance. In this case, the exigence is generated by the polarization of scientific inquiry and enunciation juxtaposed with contemporary art, as well as by a desire on behalf of the artist/rhetor to integrate and create bridges between the two. As explained in Chapter 2, solar eclipses are phenomena that are framed from very different, often dissimilar, perspectives. On the one hand, its mechanisms are commonly understood scientifically but, at the same time, it represents a precious event that is popularly celebrated and perceived of as *cataclysmic*, in Vargas Lugo's own words.[293]

This way, and far beyond the generalization of the differences between science and art, there is a dissimilar account of solar eclipses as understood from astronomy and how they are

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[292] Larson, "Lloyd Bitzer's 'Rhetorical Situation' and the Classification of Discourse," 165.

[293] Vargas Lugo, interview A.

lived bodily. Vargas Lugo was particularly interested in pointing out this difference, and this was his motivation to produce such an installation.[294] This exigence is generated mainly because of the difference in both science and art (constraints), which I am going to address in the next section. Hence, this exigence is given by the apparent biased (incomplete) account of total solar eclipses as framed by science, thus requiring the focus on other aspects of the event that are often circumvented when explaining the phenomenon.

Another *need* from which the artwork constitutes a response is also the personal inquiry that the artist is carrying out through his project. In Chapter 2, I referred to contemporary perspectives on the role of the artist. I highlighted the idea that the artist has gained new social and political responsibilities,[295] and the comparison that is often made between the latter and the scientist as researchers/knowers.[296] In this sense, Vargas Lugo's work is also a culmination of a personal inquiry to produce a new way to represent solar eclipses. As I have noted in the introduction to this thesis, *Eclipses for Austin* is not the first artwork in which he explores this specific topic. Previously, Vargas Lugo has explored, not only solar eclipses,[297] but also time, the cosmos, the future, and the aesthetics of the newspaper.[298] For *Eclipses for Austin*, as Vargas

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[294] Ibid.

[295] Marga Bijvoet, *Art as Inquiry: Toward New Collaborations Between Art, Science, and Technology* (New York: Peter Lang, 1997), 27.

[296] See, for instance, Hein, *The Exploratorium*, 147; Wilson, *Information Arts*, 4; Werret, "The Techniques of Innovation," 55; Shaw, "Convergence of Art, Science and Technology?,"162; and Sommerer and Mignonneau, "Art as a Living System," 148.

[297] Vargas Lugo has explored solar eclipses in works like *Sombras para estrellas y algunos eclipses*, *Serie Fortuna*, and *Trayectoria de eclipses*. See Chapter 1.

[298] These inquiries are reflected in works such as *Reloj I*, *II* and *III*, *Bonampak News*, and *Intemperie*. See Chapter 1.

Lugo states, he was looking for a project that would bring together most of his concerns;[299] the result is a complex artwork that contains several elements that address, independently, these interests.

Constraints

Rhetorical constraints, as explained by Bitzer, are constituted by opportunities and limitations that have the possibility to change the exigence.[300] Operative constraints are those constraints that do not depend on the rhetor and consist of beliefs, attitudes, traditions, and the like, by which the situation, the audience and the rhetor are limited and framed.[301] The identification of these constraints is central to my analysis since they constitute the factors that generate the exigence described previously and are also the specific limitations of scientific knowledge that the artwork is addressing in order to generate a proper rhetorical response. After describing these constraints I will discuss the appropriation and rearticulation of scientific knowledge, which is the strategy from which Vargas Lugo is departing in order to create his work.

Scientific Constraints

As explained in Chapter 2, there are several tenets and axioms that most scientific practices share in common and that shape the way scientific knowledge is produced and enunciated. Some of these principles constitute the constraints that derive in the exigence described previously and that are addressed and *contested* by the work of Vargas Lugo. In this

[299] Pablo Vargas Lugo, interview by C. Rodrigo Guzmán, March 2013, Interview B, transcript.

[300] Sonja K. Foss and Karen A. Foss, "Our Journey to Repowered Feminism: Expanding the Feminist Toolbox," *Women's Studies in Communication* 32, no. 1 (Spring, 2009), 37.

[301] Bitzer, "The Rhetorical Situation," 8.

section I will point out some of these principles as they operate as constraints in this rhetorical situation, and I will relate them to the specificity of the knowledge about solar eclipses as framed by science.

- Mechanisms, mathematical understanding and measurement – The first constraint is constructed by three interrelated tenets that drive the scientific inquiry in general. The first one is the idea that natural events occur as a result of mechanisms, i.e., that phenomena "are systems consisting of a collection of parts that interact with each other in order to produce some behavior."[302] The proper understanding of nature's mechanisms is often conceived of as a mathematical understanding. Brisson and Meyerstein explain that there is a generalized idea that the ultimate understanding of nature and natural phenomena is mathematical, and that this idea has prevailed in Western science since Plato's *Timaeus*.[303] This idea is related to the necessity of measurement that also shapes scientific inquiry. Measurement, according to Chang and Cartwright is the symbolic assignment of values to what is observed in an event.[304]
- Determinism and prediction – If natural phenomena are the result of mechanisms that are available for us to know and understand, therefore, all natural events are determined

[302] Stuart Glennan, "Mechanisms," in *The Routledge Companion to Philosophy of Science*, ed. Stathis Psillos and Martin Curd (London: Routledge, 2008), 376.

[303] Luc Brisson and F. Walter Meyerstein, *Inventing the Universe: Plato's Timaeus, the Big Bang, and the Problem of Scientific Knowledge* (Albany: State University of New York Press, 1995), 5.

[304] Hasok Chang and Nancy Cartwright, "Measurement," in *The Routledge Companion to Philosophy of Science*, ed. Stathis Psillos and Martin Curd (London: Routledge, 2008), 368.

by these mechanisms. Determinism in science, as Loewer explains,[305] entails a *logical reasoning* that prescribes the way an event is going to unfold based on the previous requirements (mechanisms) that produces it. This idea is intrinsically related to the next axiom/constraint, which is the possibility to predict natural events. If an event is determined by mechanisms, and if these mechanisms are known and understood, therefore, natural events can be predicted and *postdicted* (i.e., description of an event occurred in the past).[306]

- Knowledge without meaning – As explained by Snellman, since Galileo in the seventeenth century, the development of scientific thought has presupposed that knowledge acquired through these means lacks of meaning.[307] In other words, natural events, astronomical phenomena, biological processes, and the like occur in nature independently and carry out no further meaning for us or for nature. Rosenberg explains that the ultimate step to support this idea was the development of the theory of evolution during the nineteenth century, because it "demonstrated" that the natural world operates outside ideas of transcendent purpose or of divine, immutable, design.[308]

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[305] Barry Loewer, "Determinism," in *The Routledge Companion to Philosophy of Science*, ed. Stathis Psillos and Martin Curd (London: Routledge, 2008), 328.

[306] Malcolm Forster, "Prediction," in *The Routledge Companion to Philosophy of Science*, ed. Stathis Psillos and Martin Curd (London: Routledge, 2008), 405.

[307] Hakan Snellman, "The Scientific Project: Knowledge Without Meaning?" in *How Do We Know?: Understanding in Science and Theology*, ed. Dirk Evers, Antje Jackelén, and T. A. Smedes (London: T & T Clark, 2010), 53-55.

[308] Alexander Rosenberg, "Biology," in *The Routledge Companion to Philosophy of Science*, ed. Stathis Psillos and Martin Curd (London: Routledge, 2008), 511-512.

- Common ownership – This constraint is, in fact, the enabler of Vargas Lugo's use of scientific knowledge, thus being a possibility of the rhetorical situation. This idea, as explained by Merton under the label of *communism*,[309] indicates that "there is a common ownership of goods in the scientific knowledge,"[310] thus suggesting that knowledge is not *property* of researchers but of humanity as a whole. This is also related to the generalized "underlying belief in a material reality"[311] that is also shared by most scientific disciplines, as Mendelsohn explains. In this sense, scientific knowledge is not understood as *produced* but rather *discovered* out of the physical world. I will elaborate on this idea when I describe the strategies of appropriation and rearticulation later in this same section.

Summarizing the constraints explained above, these describe in general the scientific account of solar eclipses as events that 1) are the result of astronomical mechanisms, which are understood by their mathematical dimension; 2) are determined by these mechanisms and, therefore, can be predicted and postdicted with accuracy; 3) lack meaning beyond their mechanical operation; and 4) their knowledge is universal and shared throughout humanity.

Solar eclipses, as previously stated, entail these constraints. Additionally, and in a more specific sense, solar eclipses as framed by astronomy contain further constraints that delimit the rhetorical situation. First, as explained in Chapter 2, it is the disciplines of astronomy and

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[309] Leslie Sklair, *Organized Knowledge: A Sociological View of Science and Technology* (St. Albans: Hart-Davis MacGibbon, 1973), 109.

[310] Ibid., 112.

[311] Everett Mendelsohn, "The Social Construction of Scientific Knowledge," in *The Social Production of Scientific Knowledge*, ed. Everett Mendelsohn, Peter Weingart and Richard Whitley (Dordrecht, Holland: D. Reidel, 1977), 6.

astrophysics that are in charge of providing an explanation of what the phenomenon is. Also, astronomy complies with the tenets explained previously in regard to conceiving of solar eclipses as events without meaning. There is, nonetheless, acknowledgment of the power of solar eclipses and recognition of its significance in different cultures and times but, as I laid out in Chapter 2, these acknowledgments usually frame that significance as otherness.[312] Furthermore, when astronomy refers to other (often ancient) cultures and their relationship to eclipses, it is to praise their mapping methods and to relate them as antecedents to contemporary scientific methods.[313]

Finally, after mapping methods are set and commonly accepted by the scientific community,[314] astronomers and astrophysicists, in general, lose their interest in solar eclipses as objects of study, but become interested in using them as research *tools* to test other phenomena;[315] this idea is summarized by astrophysicist Jay M. Pasachoff when he refers to solar eclipses as the "astrophysical laboratory."[316] These constraints not only offer a scientific account of how the phenomenon is understood, but also expose its importance and significance to the scientific community as an astronomical event.

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[312] "Eclipses Through Traditions and Cultures. Interpreting Eclipses," NASA, Goddard Space Flight Center Eclipse 99 Website, accessed March 2013, http://education.gsfc.nasa.gov/eclipse/pages/traditions_Interpret.html.

[313] See, for instance, Felix Verbelen, "Solar Eclipses on Earth, 1001 BC to AD 2500," last modified November 2003, http://users.online.be/felixverbelen/catzeute.htm.

[314] See, for instance, R. Baptista and J. E. Steiner, "Improving the Eclipse Mapping Method," *Astronomy and Astrophysics* 277 (1993).

[315] Scientist use solar eclipse observations to inquire about variations in gravitation, test relativity, discover chemical components, etc. See Wang, et al., "Precise Measurement of Gravity Variations;" Earman and Glymour, "Relativity and Eclipses;" and Ostdiek and Bord, *Inquiry into Physics*, 136.

[316] Jay M. Pasachoff, "Solar Eclipses as an Astrophysical Laboratory," *Nature* 459, no. 7248 (2009).

Contemporary Art and Artistic Constraints

Let us remember that Bitzer's concept of constraints within the rhetorical situation is constituted by limitations as well as possibilities that shape the exigence. In this sense, the majority of the artistic constraints to be described are, in fact, enablers for the rhetorical response; after all, my thesis is concerned with how contemporary artistic practices can serve as a space to expand on scientific knowledge. Nonetheless, I have also identified limiting constraints that make this epistemological enterprise not as easy as it is claimed and, therefore, I am going to describe these as important constraints operating in this rhetorical situation.

Art, as I previewed, is often referred to as a space of freedom and experimentation in which different issues and questions might be posed and addressed. For instance, utilizing McLuhan's concept of media environments,[317] which work as envelopes that wrap us and, therefore, are intrinsically imperceptible, Elena Lamberti states that art can serve as a counter-environment, an outsider, in order to make those environments visible.

> In other words, art (literature, visual arts, new installations and performances) become the counter-environment suggested to speculate, in real time, on the effects that, in time, new technologies have on the environment and on our societal matrixes; it offers to individuals a way to retrieve an active role in the making of individual and collective identity, something that is to be defined (or redefined) also through the act of remembering.[318]

This statement is strongly related to McLuhan's conception of art as autonomous and operating under its own assumptions.[319] As Lamberti points out, McLuhan considered art (for

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[317] "Basic McLuhan: Marshall McLuhan and the Senses," GingkoPress.com, accessed April 2013, http://www.gingkopress.com/02-mcl/z_mcluhan-and-the-senses.html.

[318] Elena Lamberti and Marshall McLuhan, "Orality, Literacy and New Orality: Forms of Remembering and Technologies of Communication," in *Proceedings of the conference on Memory and Mediation European Narratives of identity* (2004), 8.

[319] Marshall McLuhan, *Counterblast* (New York: Harcourt, Brace and World, 1969), 24.

instance when talking about painter Wyndham Lewis) to be a *place* from which to look back to our environments and reflect on them: "McLuhan always considered Lewis's productions as counter-environments determined to detect and express cultural, societal and technological change."[320]

Julian Stallabrass, on the other hand, when discussing the idea of art as a *zone of freedom* states that

> The freedom of art is more than an ideal. If, despite the small chance of success, the profession of artist is so popular, it is because it offers the prospect of a labour that is apparently free of narrow specialization, allowing the artists, like heroes in the movies, to endow work and life with their own meanings.[321]

Stallabrass later expands on the forces and rules of the market, art galleries, and exhibition spaces to develop his ideas[322] but, besides the economical and political constraints of art, in regard to its production, it could offer a more or less space of freedom in which to address social, political, or even scientific issues with innovative perspectives.

Other artistic constraints that affect the situation in regard to the intersection of art and science is the lack of a common ground of what transdisciplinary collaboration between the two should produce.[323] This apparent discrepancy is, nonetheless, often overestimated. The lack of common goals does not necessarily lead to rejection to collaborate. Curator Dávila-Villa

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[320] Elena Lamberti, "Blowing Off the Dust: On Marshall McLuhan and Counterblasting," in McLuhan, *Counterblast* (New York: Harcourt, Brace and World, 1969), 29.

[321] Julian Stallabrass, *Art Incorporated: The Story of Contemporary Art* (Oxford: Oxford University Press, 2004), 3.

[322] See Ibid., 100-102.

[323] Martin Tröndle, "The Entanglement of Arts and Sciences: On the Transaction Costs of Transdisciplinary Research Settings," *Journal for Artistic Research* 1 (2011), http://www.researchcatalogue.net/view/?weave=9528&x=0&y=0.

explained that when Vargas Lugo approached other departments at UT, it was easier for him to be listened to for "researchers see artists more as equals than curators;"[324] thus confirming the postures outlined in Chapter 2, in which the role of the artist is analogous to that of the scientist or researcher. In *Eclipses for Austin*, however, due to the nature of the topic or the ambitions of the artist, transdisciplinary collaboration with science was neither essential nor necessary. In the next section, I will elaborate on how these specific constraints led the artist to use appropriation and rearticulation as his artistic strategies to bridge the two disciplines.

Finally, given that *Eclipses for Austin* is a visual work, the expectation of scientific visualization also constitutes a constraint. As discussed in Chapter 2, visualization is often understood as the visual rendering of scientific discoveries and results under the claim that it *facilitates understanding*.[325] However, when visualization is subsumed to a scientific enterprise, it automatically assumes its principles and axioms (some of the constraints described in the previous section), i.e., the idea of veracity, lack of meaning, accuracy, measurement, etc. The limitations of such expectation are contested by Vargas Lugo's choice of how the image is constructed and what it represents, which I will address in detail in subsequent sections of this analysis.

Appropriation and Rearticulation

When trying to identify how the artwork is contributing to knowledge, I noticed that, to start, the artist is not discovering knowledge about solar eclipses through alternative methodologies to those of science; that is, the artist did not engage in empirical research to trace

[324] Úrsula Dávila-Villa, interview by C. Rodrigo Guzmán, July 2012, transcript.

[325] See, for instance, Lemke, "Multiplying Meaning;" Dean, "Dimensions of Data, Turned Into Art That Speaks;" and McCandless, "The Beauty of Data Visualization."

solar eclipses or to discover what the phenomenon is. Rather, he is purposely using and rearticulating what is already known about these phenomena as enunciated by science through the use of charts that map future eclipses. However, it is in the use and re-enunciation of these very same data that the artwork proposes any new knowledge about the event.

Originally, I considered describing this gesture as part of the fitting response of the artwork as rhetorical artifact, but later I realized that rather than a discourse emerging from the artwork, the appropriation and rearticulation of scientific knowledge is the strategy the artist is using to approach the issue. Appropriation has been a common practice in contemporary art since the late 1960s. In general, appropriation in art has been related to the use or copy of images that are not produced by the artist and is often considered to be a reflective gesture that draws attention to the very nature of authorship, ownership, and creation.[326] Nevertheless, appropriation often refers to images and, more specifically, artistic images. Elaine Sturtevant is recognized as a pioneer of artistic appropriation who, during the 1960s, imitated with stunning correspondence the works of artists like Roy Lichtenstein, Claes Oldenburg, Jasper Johns, Frank Stella, and Andy Warhol.[327]

As Sherri Irvin points out, appropriation became a common topic in art once it was performed in appropriating art itself, [328] like in Sturtevant's appropriations or in works by artists like Sherrie Levine, Richard Prince, Cindy Sherman, Barbara Kruger, and Yasumasa Morimura; however, this practice was already common in art by artists like Warhol who inserted popular

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[326] Texts like Michael Foucault's "What is an Author?" and Roland Barthes's "The Death of the Author" are often cited as indispensable references to understand appropriation in art.

[327] Sherri Irvin, "Appropriation and Authorship in Contemporary Art," *The British Journal of Aesthetics* 45, no. 2 (2005), 124.

[328] Ibid.

imagery into the fine arts world or, significantly earlier than him, Marcel Duchamp who, in the early twentieth century, utilized mass produced daily-life objects. In this sense, appropriation in art should be understood, beyond the idea of the copy, as intertextuality, in other words, as a *citation* that borrows elements, information, approaches, etc., from other practices or people. Thus, appropriation should not be reduced only to images but also to methods, data, perspectives, and the like. Artist Hans Haacke is an excellent example of an artistic practice that resembles a methodology used, in this case, in social sciences and political polls.[329] Another remarkable example is Mary Kelly's work *Post-Partum Document*, developed between 1973 and 1979, in which Kelly documented six years of her mother-child relationship with her son.[330] The installation of the artwork featured notes, diagrams, objects, photographs and other documents that recreated an almost archaeological documentation of the process. The piece served also as an empirical contestation to Lacan's psychoanalytical theories about the child's fantasies and fixations with the mother, thus also contributing to knowledge.[331]

In the case of *Eclipses for Austin*, although the artist arguably is utilizing a conventional visual representation of the eclipsed sun,[332] the main form of appropriation is the use of knowledge generated from science. Maps of solar eclipses are usually published in large catalogs

[329] Bijvoet, *Art as Inquiry*, 87.

[330] Craig Owens, "The Discourse of Others: Feminists and Postmodernism," In *Beyond Recognition: Representation, Power, and Culture*, ed. Craig Owens and Scott Stewart Bryson (Berkeley: University of California Press, 1992), 173.

[331] Ibid.

[332] This convention is not given by the way the image is constructed, but by the visual signs that represent the sun and the moon, as well as the depiction of the moon's transit.

that feature charts of the past and future eclipses that will be seen from several places in earth.[333] It is this information what Vargas Lugo is utilizing as his departure point to focus on four future solar eclipses that will be experienced from the Austin/Texas area.

Conversely to the use of images, which often leads to copyright issues and legal confrontations, appropriating science appears to be *harmless*. If this is the case, it is so because of the very constraints of scientific inquiry. As explained in previous chapters, science is enunciated as the ultimate form of knowledge production that, in order to operate properly, should be communicated and publicly owned.[334] It is in this sense that the artist's inclusion of this knowledge is rather a gesture of intertextuality than of appropriation, thus being aligned, to some extent, to the scientific discourse of collective ownership and usage. Vargas Lugo's use of this information made me reflect on who the owner of scientific knowledge is? Is it he or she who produces it or the person who uses it to create something else?

Vargas Lugo's use of scientific information (data) could be perceived of as mere inclusion of knowledge in the same way other artists utilize knowledge about materials, concepts, theories, and the like to produce their works. However, I propose that it is correct to see his gesture as a gesture of appropriation since he not only uses the information but also presents it in a way similar to how it is usually presented in scientific charts. The first two pages of the brochure *Sun*, which accompanies the installation, present three charts listing a) all the future eclipses to be seen from the Austin, Texas area up to 3000 CE; b) the next ten total

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[333] See, for example, Fred Espenak, "Five Millennium Catalog of Solar Eclipses," NASA Eclipse Website, last modified August 31, 2009, http://eclipse.gsfc.nasa.gov/SEcat5/SEcatalog.html#2.

[334] Georg Franck, "Scientific Communication--A Vanity Fair," *Science* 286, no. 5437 (1999), 53.

eclipses whose umbral path will cross over Texan territory; and c) the four eclipses performed at the UT Stadium for the installation (Figures 16a and 16b). These three charts resemble those from science, in which solar eclipses are listed; in future sections I will go in detail on how these charts also differ and offer an alternative experience to data presentation.

For this piece, Vargas Lugo's intention was originally to work in collaboration with the Astronomy department at the University of Texas.[335] Curator Dávila-Villa also stressed the importance of the WorkSpace program's aim to foster collaboration between different departments within the university.[336] However, when Vargas Lugo approached the UT's department of Astronomy, few people were interested in collaborating in the project, probably, as Vargas Lugo himself points out, due to the idea of solar eclipses as events of mere popular interest (rather than of scientific interest), and the lack of necessity to further scientific inquiry on the nature of this phenomenon.[337] In Chapter 2, I elaborated on the complications and issues that often arise when the scientific and the artistic disciplines aim to collaborate. One of these complications is the lack of *common ground,* or similar expectations, that the participants have at the moment of the collaboration; this issue has been already highlighted by several studies.[338]

The artist, later, as he explained to me, discovered that the collaboration with astronomers and astrophysicists was not *necessary*, and that most of the information he used regarding solar eclipse mapping is available online and in other sources.[339] This derived, I think, from the

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[335] Vargas Lugo, interview A.

[336] Dávila-Villa, interview.

[337] Vargas Lugo, interview A.

[338] See, for instance, Tröndle, "The Entanglement of Arts and Sciences."

[339] Vargas Lugo, interview A.

appropriation of this knowledge in order to create something else, instead of attempting to propose an alternative methodology to achieve the former, or to create transdisciplinary collaboration between the artist and scientists.

In this sense, Vargas Lugo's ultimate aim was the rearticulation of scientific knowledge. As he explained to me, his intention was neither to contest nor to discredit knowledge as enunciated from science,[340] but to use it and reframe it in a different way; thus, his piece intends to utilize a result of scientific inquiry and provide it with a different visual representation.

According to Vargas Lugo, when artists are engaged in projects that include science or technology, they often do so in order to give the work a sense of accuracy, of truth, providing it with some sort of validation.[341] Conversely, he opted to utilize an almost *incoherent*[342] form of representation that challenges science, the card-stunt performance.[343] This operative decision is crucial, and I will return to it when I discuss the responses that the work of art proposes in terms of collectiveness and the memory of the future; for now, however, I just wanted to point out only what Vargas Lugo is retaking from science and what exactly is he proposing to scientific enunciation and representation.

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[340] Ibid.

[341] Pablo Vargas Lugo, interview by C. Rodrigo Guzmán, March 2013, interview B, transcript.

[342] Vargas Lugo refers to his representation of the eclipses as *incoherent representations*, because science often seeks either *realistic* representations or schematic abstractions to convey natural processes visually. On the other hand, the composition of the images that Vargas Lugo proposes requires a collaboration of more than 200 people to be produced, which could be also added to its *incoherency*.

[343] Vargas Lugo, interview B.

Finally, and as a prelude to the discursive responses that I will describe in subsequent sections, when I asked the artist the reason why he wanted to focus on this topic (total solar eclipses), and through this specific way of operating (appropriating scientific knowledge), he responded that he was interested in what is irrelevant to science, what is excluded, i.e., the *sawdust* of the scientific,[344] to use his own words. I find this response correspondent with Adorno's idea that art contributes to knowledge by drawing attention to what is excluded from it.[345] In this sense, I think that the discursive responses that I am about to describe express the intention of the artist to draw attention to those features that exist during solar eclipses, but which do not constitute the centrality of the scientific account of such phenomenon.

In the next section of the analysis I will proceed to identify and describe the five discourses that emerge from the work of art: 1) collectiveness; 2) location and particularity; 3) temporality and duration; 4) memory of the future; and 5) symbolism as they constitute what Bitzer calls a fitting response in the rhetorical situation.

Response I: Collectiveness

One of the first features to stand out from *Eclipses for Austin* is that the image of the eclipses is formed through a card-stunt performance, in which participants flip two-colored cards to recreate the sun being occulted by the moon's path. Vargas Lugo's idea was to create an image made by the collectivity that the event supposes.[346] For the artist, these events gather

[344] Vargas Lugo, interview A.

[345] Adorno, *Aesthetic Theory*, 70.

[346] Vargas Lugo, interview A.

people around, thus becoming collective spectacles. In this sense they are related to sports and other social events.[347]

This feature of the work represents the main rhetorical response that the artwork contains because it is the only one of the five that in fact proposes to focus on an aspect of solar eclipses that is often disregarded from most scientific accounts of the event, the idea that solar eclipses are lived collectively and socially. As I will explain later, the rest of the responses work to draw attention to aspects that are regularly contained in science but that have less importance than the mechanical description of the event.

Collectiveness in Vargas Lugo's work resembles the way eclipses are being experienced in the social world, and it is presented not only in the way the four eclipses are depicted and enacted but also by the act of placing the representation in a sport stadium, thus making the connection with other collective events. At the same time, Vargas Lugo proposes a *new* way to represent the scientific.[348]

The idea of the collective is also present in the choice of news-like brochures that convey part of the idea of the artwork to the public, as well as the presentation of the performances in four television screens displayed in the gallery, which show the massiveness of solar eclipse experience. As Vargas Lugo explained to me, not only is the event lived and experienced socially, but it is also highly mediated.[349] Before and after the event has occurred, the media

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[347] Ibid.

[348] Vargas Lugo has already explored alternative forms of representation of science, such as in his previous work *Serie Fortuna* (2008), in which stellar and cosmic maps are represented with coins.

[349] Vargas Lugo, interview B.

provide full coverage of it, and these images are always present in the experience of the phenomenon.

As a result of this overwhelming mediation, the artist explains, thousands of similar images appear everywhere.[350] As a response to this *cliché*, Vargas Lugo decided to create an image that was *incoherent* to what it represents.[351] As previously explained, scientific visualization often is subsumed to the norms and tenets of science; regarding solar eclipses in specific, these images are either "historical" accounts of previous eclipses captured by cameras or computerized animations of the event as abstract, i.e., without any reference to an specific eclipse. I will elaborate on this idea when I talk about the fourth response, the memory of the future, and discuss Vargas Lugo's intentions to *document* an event that has not happened.

When Vargas Lugo arrived in Austin, Dávila-Villa explains, he already had the idea to work, somehow, with card-stunt performances (Figures 1 and 2).[352] Vargas Lugo was first interested in the idea when, while living in Peru, he watched the videos of the prisoners of the Shining Path Communist Party of Peru,[353] in which its adherents recreate images of the hammer-and-sickle symbol while chanting revolutionary slogans.[354] Vargas Lugo wanted to, first, use a

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[350] Ibid.

[351] Ibid.

[352] Dávila-Villa, interview.

[353] The Shining Path Communist Party of Peru (in Spanish *Partido Comunista del Perú-Sendero Luminoso*) is a Maoist-inspired guerrilla insurgent organization in Peru that was highly active during the 1980s and 1990s and that still operates in that country. See David S. Palmer, *The Shining Path of Peru* (New York: St. Martin's Press, 1992); and Gustavo Gorriti, *The Shining Path: A History of the Millenarian War in Peru* (Chapel Hill: University of North Carolina Press, 1999).

[354] Vargas Lugo, interview B.

technique that entails communal unity in order to be created, and secondly, to provide this often perceived as *mundane*, pre-cinematographic performance with another use (scientific or artistic).[355] In this sense, Vargas Lugo's choice of the card-stunt performance not only creates an image *sine manufacta*, which paradoxically complies with scientific standards of detachment and no interpretation, but it is in itself an embodiment of collectivity.

When Vargas Lugo explained to me his inspiration on the Shining Path, I commented that, indeed, these types of performances often remind me of either communist or totalitarian regimes.[356] He agreed that this technique is often used propagandistically, and this is why he wanted to use it for *something else*, to show something beyond the political.[357] In fact, he commented that he was invited to write about the political implications of this piece through this type of performance, which he thinks are, if existent, quite subtle.[358] In this sense, the artwork is completely different from *Estadio Azteca* by British artist Melanie Smith, a piece that represented Mexico in the 2011 Venice Biennial, which uses the same performance technique. In her piece, Smith, in collaboration with curator José Luis Barrios, addresses the political instability of Latin American countries and offers a critique of the state of chaos and ruin that, arguably, prevails economically and politically in this area.[359]

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[355] Ibid.

[356] In this regard, the *arirang* performances in North Korea are an example of stunning perfection and massiveness.

[357] Vargas Lugo, interview B.

[358] Ibid.

[359] Gatopardo, "La Bienal de Melanie Smith," Gatopardo.com, last modified July 2011, http://www.gatopardo.com/GaleriaGP.php?I=36#leaf.

Finally, beyond representing the collective aspect of solar eclipses, the work pretends to resemble the power of convocation that such phenomena entail. Part of Vargas Lugo's idea was to recreate those four eclipses not only by their visualization but also by their function. Although the artwork is not the performance, since the eclipses were recorded and later presented in the gallery, the representations required a large number of volunteers, hence an open call was released. Vargas Lugo's purpose with this is clear; at the end of the artistic statement for the piece, the artist states that "*Eclipses for Austin* aims to become a platform where a grand experience can be shared by many creating a sense of community and exaltation."[360]

Through this feature especially, then, Vargas Lugo draws attention to how the event is constructed, not as an astronomical event but as a social/collective event that needs to be experienced and charged with social meaning in order to exist. As he states, this artwork delves into the idea that "solar eclipses are not astronomical events, they occur here in Earth."[361]

Response II: Location and Particularity

Future and past solar eclipses, as explained previously, are often described by science in long systematic charts. These publications, like NASA's "Five Millennium Canon of Solar Eclipses," regularly feature coordinates and graphics that show specific paths of eclipses and the places from where they will be/were observed.[362] Certainly, the information regarding location and particularity is not missing in the scientific account of the phenomenon. Nevertheless, this

[360] Pablo Vargas Lugo, "WorkSpace 11: Pablo Vargas Lugo, *Eclipses for Austin,*" (Artistic statement, Blanton Museum, 2009).

[361] Vargas Lugo, interview A.

[362] Espenak, "Five Millennium Catalog of Solar Eclipses."

enunciation neither highlights those specificities nor picks out particular eclipses over others. This is related to the axiomatic scientific belief in the universality of knowledge.

As opposed to the scientific framing of the event, *Eclipses for Austin* is concerned with locality, because it represents eclipses that will be visible from a very specific geographical area. Particularity, on the other hand, is present in the selection of the four eclipses that are simulated. The work presents reenactments of four future eclipses—April 8, 2024; April 14, 2200; July 17, 2205; and February 25, 2343.

I find that this gesture of locality complies with contemporary critiques of science, for instance, Haraway's idea of the *situated knowledge.* For her, the premise of scientific objectivity is nothing but an idealistic fallacy: "objectivity turns out to be about particular and specific embodiment and definitely not about the false vision promising transcendence of all limits and responsibility."[363] As a result, she proposes instead a "feminist objectivity is about limited location and situated knowledge, not about transcendence and splitting of subject and object proposition."[364]

Although Haraway speaks of location in a more abstract way, i.e., regarding acknowledgment of the position of the researcher and his or her biases, I think Vargas Lugo's piece is a material example of situated knowledge. For Haraway, objectivity is *irresponsible knowledge*[365] when it claims totality because it does not depart from any *body*. Haraway

[363] Donna Haraway, "Situated Knowledges: The Science Question in Feminism and the Privilege of Partial Perspective," *Feminist Studies*, 14, no. 3 (1988), 582.

[364] Ibid., 583.

[365] Ibid., 584-585.

advocates for a knowledge that focuses again on the located body.[366] In this sense, Vargas Lugo's work is an example of situated knowledge, not only because it focuses on a geographical location but also because, as we shall see, it departs from the body, from the personal, individual, located experience with solar eclipses.

Location is evident from the very name of the project, but it is also present through many other elements that are included in the brochure in the gallery. The first image in the *Sun* brochure, after the cover, is a map of Texas on the third page (Figure 17), showing the four paths of the eclipses being reenacted. It is notorious how each umbral path differs from one another both in location as well as in width. The umbra for the eclipses on 2024 and 2343, for instance, cross Austin, although they differ in width, whereas the umbra for the eclipse in 2200 crosses the state almost horizontally far away from Austin.

The videos presented in the gallery concordantly differ from one another in duration and perspective of the camera (Figures 3 and 4). I will discuss time and duration in the next section. The camera position in each one of the four videos makes the experience with each one different. While the first eclipse, April 8, 2024, presents the eclipse almost from a central shot, the next one, April 14, 2200, presents it from a ground level, "worm's-eye," angle shot. The eclipse in 2205 is shot from an entrance to the stadium and, finally, the 2343 eclipse is shot directly from the opposite side of the stadium, also from a ground level angle.

In pages five and six of the brochure (Figure 18), a schematic representation of the four eclipses is presented, showing the difference in the way the moon will cover the sun as observed from Austin, Texas. The brochure also features photographs of each reenactment; however, each performance, in the brochure, presents different amount and arrangement of pictures. The first,

[366] Ibid., 582.

the next Austin eclipse in 2024, features a single double-page spread in the middle of the newspaper. The 2200 eclipse is presented in ten pictures arranged in three rows (Figure 19). The 2205 eclipse is presented in 32 pictures arranged in four eight-column rows (Figure 20). Finally, the last eclipse, the one in 2343 is presented in 40 pictures arranged in eight five-column rows (Figure 21).

What is the purpose of these differences? I think the work appeals to the different ways that we experience these events, the different places, moments, memories that come to mind when remembering them. The work is highly personal, and although audience analysis is not part of this thesis, some personal accounts and testimonies, which are included in the brochure, might be analyzed as part of the artifact.[367] The curatorial text, written by Dávila-Villa, appearing in pages seven to eight, describes a reflection on her own relationship with solar eclipses that Vargas Lugo's work has triggered. The text starts as follows:

> While living in Mexico City, I witnessed one of the longest solar eclipses of the last decade on July 11, 1991. Never before have I experienced nighttime darkness descend in the middle of the day as the sun became totally eclipsed by the moon and its delicate ethereal corona became visible while the horizon turned into a splendid spectacle of sunset colors.[368]

The focus on location and particularity might appear to be obvious in the work; however, as Vargas Lugo expresses, what the project aims for is to propose a way of representing,[369] thus providing a mobile work that might be reproduced anywhere and whose results would vary accordingly. In fact, the work has been proposed to be recreated in other cities like Buenos Aires,

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[367] A second testimonial, by one of the participants of the performance, is presented in page 13 of the *Sun* brochure.

[368] "Sun," (Brochure to *Eclipses for Austin*, Blanton Museum, 2009), 7.

[369] Vargas Lugo, interview A.

Mexico City, Porto Alegre, and others.[370] In this sense, it is a work that *pertains* to a specific group of people, a specific community.[371]

The focus on location and particularity, according to the artist, also contests, in a located way, the knowledge that solar eclipses are cyclical and, furthermore, abundant. Scientific knowledge of the phenomenon's mechanisms, as well the astronomical mapping of it, shows that, given the geometrical aspect of the event, solar eclipses are actually cyclical,[372] and not as *rare* as we think.[373] However, Vargas Lugo's work draws attention to the personal, located experience of eclipses, as once-in-a-lifetime events that are, primarily, experienced bodily and personally.

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[370] Ibid.

[371] It might be added that, through this *mobility*, the work also plays with Benjamin's idea of the aura, because, as noted by James W. Carey, "the key to the loss of aura is again the locational movement, the removal of the work from the here and now and its transportation elsewhere." See James W. Carey, "Walter Benjamin, Marshall McLuhan, and the Emergence of Visual Society." *Prospects: An Annual of American Cultural Studies* 12 (1987), 31. In this case, nevertheless, the lost of the aura would refer to solar eclipse's aura given by the mobility of the work as well as for the elements that address the highly mediated nature of the event.

[372] See, for instance, Ron Hipschman, "Why Eclipses Happen," Exploratorium Solar Eclipse Website, accessed March 2013, http://www.exploratorium.edu/eclipse/why2.html. Additionally, as Espenak explains, "the periodicity and recurrence of eclipses is governed by the Saros cycle, a period of approximately 6,585.3 days (18 years 11 days 8 hours)." See Fred Espenak "Eclipses and the Saros**,**" NASA Eclipse Website, last modified January 12, 2012, http://eclipse.gsfc.nasa.gov/SEsaros/SEsaros.html.

[373] Hipschman explains that at least one type of eclipse is guaranteed every six months somewhere in Earth; see Hipschman, "Why Eclipses Happen." Espenak, on the other hand, explains that eclipses would occur every month if it there was no difference in inclination between the orbits of the Earth and the moon; see Fred Espenak, "Solar Eclipses for Beginners," Mr. Eclipse, last modified 2009, http://www.mreclipse.com/Special/SEprimer.html. Golub and Pasachoff explain that, on average, a given location experiences a solar eclipse once every 375 years; see L. Golub and Jay M. Pasachoff, *The Solar Corona* (Cambridge: Cambridge University Press, 1997), 116.

Response III: Temporality and Duration

In the same way that location and particularity are provided in scientific charts of solar eclipses, specific durations often accompany these data; thus, this information is not particularly absent either. However, just as in the previous section, temporality and duration are secondary in the scientific enunciation of solar eclipses or, when present, lost in a *sea* of numbers and coordinates. Elements like the use of video and music and adding a *soundtrack* to the phenomenon expose the artist's concern with the actual temporality of the event; that is, the real measurable time that the eclipse takes to occur.

Due to the geometry of the event and the position of the celestial bodies, each solar eclipse differs significantly from others. The distance between the Earth and the moon is approximately 238,900 miles; between the Earth and the sun is 92,960,000 miles; and, as explained by Seeds and Backman, the sun is 400 times larger than the moon but nearly 400 times farther away.[374] Given these proportions, the moon's umbra during a solar eclipse is never bigger than 168 miles (270 km), and it *sweep*s the Earth's surface at 1000 mph (1600 km/hr); thus the sun cannot be totally eclipsed for more than seven and a half minutes.[375] According to NASA, the shortest total solar eclipse lasted for one minute and 50 seconds, in 1882, and the shortest annular eclipse lasted for only 21 seconds, in 1810.[376] Therefore, the duration of a solar eclipse ranges from just a few seconds to seven minutes and 30 seconds.

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[374] Michael A. Seeds, and Dana E. Backman, *Universe: Solar System, Stars, and Galaxies* (Boston, MA: Brooks/Cole, Cengage Learning, 2012), 37.

[375] Ibid.

[376] "Saros Series Catalog of Solar Eclipses," NASA Eclipse Website, last modified September 26, 2009, http://eclipse.gsfc.nasa.gov/SEsaros/SEsaros126.html.

The first significant element in Vargas Lugo's artwork is the use of video (Figures 3 and 4). When discussing the similarities and differences between photography and video, Christian Metz states that video, through movement and plurality, implies time[377] and, citing Peter Wollen, explains that this imposes a "reading time."[378] Therefore, as opposed to a photograph, the viewer is required to experience *Eclipses for Austin* within a temporal framework.

The next significant element is the addition of music to each eclipse. Vargas Lugo expressed to me his interest in musicalizing, or almost choreographing, each eclipse to provide the event with specific temporality. For the music, he worked with percussionist Eric Peterson to create a musical composition to accompany the representations. The composition consists of a percussion beat (about 40 bpm), utilizing more than 12 instruments,[379] that mark the card flipping. According to Metz, sound in video also affects time, because "one of the properties of sounds is their expansion, their development in time (in space they only irradiate), whereas images construct themselves in space."[380] In this sense, both movement and sound, through the use of the video, foster a timely experience with the event, as opposed to a mere spatial or representational encounter with the image. The use of sound also served to assure unity while the participants flipped the cards during the performance.

In the gallery, each eclipse had its own duration and was screened at separate times; this way, the audience in the gallery would experience eclipses differently, not only given the different angles and perspectives in which they are being shot, but also by their different

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[377] Christian Metz, "Photography and Fetish," *October* 34 (1985), 83.

[378] Ibid., 81.

[379] Vargas Lugo, interview A.

[380] Metz, "Photography and Fetish," 83.

durations and screening times. This feature, in a way similar to the previous one of location and particularity, draws attention to the specific duration of each eclipse and, thus, differentiates each from the other.

Response IV: Memory of the Future

One of the axiomatic tenets of science, which has already been described and discussed, is the idea of predictability. Solar eclipses are immersed in a dichotomy that is given by, on the one hand, the stunning bodily experience of the event and, on the other hand, its accurate predictability through the use of mathematical formulae. Eclipse mapping is, relatively, an easy enterprise;[381] prediction of solar eclipses and other astrophysical phenomena is the result of meticulous and highly accurate tracing methods.

Eclipses for Austin exposes this dichotomic interplay of accuracy and prediction with the social impact, both collective and individual, that these phenomena entail. This projected *memory* is present in many elements of the artwork, from the chart of eclipses that will take place between the years 2010 and 3000 presented in *Sun* to the *testifying* act of recording the reenactment of the eclipses to the action of witnessing the event that has not yet happened but whose date and time is well-known in advance.

Vargas Lugo has shared with me that his intention was to create both an artwork whose content refers to something *beyond* the present, as well as an artwork with an "expiration date."[382] This adds to the interplay recently discussed: on the one hand, the participants of the performances are reenacting eclipses that will take place in the future, some of which, with

[381] Although, as reviewed in Chapter 2, mapping methods are still being debated within the scientific community.

[382] Vargas Lugo, interview B.

accurate certainty, they will not be able to experience in their lives; on the other hand, although the furthest eclipse represented will take place in 2343, after this date, the artwork will be obsolete and reduced to nothing more than a representation of past events.

The theme is reiterated by the *Sun* brochure developed, according to Vargas Lugo, to create the sensation that it is *documenting* an event of the past (Figures 5 and 15).[383] The display of *Sun* in the gallery took the shape of a newsstand aesthetic that has been previously explored by Vargas Lugo in works like *Bonampak News*. The newsstand, the "information urban sculpture" as Vargas Lugo calls it,[384] relates both to the massiveness of the events and to the idea of the past event and, then again, to the ambiguity of the use of time in the work (the future event made present, and then transformed into past, etc.).

The choice to recreate future events and then document them challenges the mere scientific idea of the *document*. In general terms, as explained previously, the scientific image of a solar eclipse is either a documentation of a historical event, or a schematic representation of the phenomenon in abstract. In semiotics, according to Peirce's theory of signs, the signs that relate to their referents in a physical way and *testify* to their existence, because they are physically affected by the referent, are referred to as *indexes*.[385] Photographs of previous eclipses would be indexes. In contrast, abstract representations that relate to their referents through a process of convention are called *symbols*.[386] The schematic scientific representations of eclipses as abstract events would be symbolic in nature.

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[383] Ibid.

[384] Ibid.

[385] Charles S. Peirce, *La ciencia de la semiótica* (Buenos Aires: Nueva Visión, 1974), 30.

[386] Ibid., 30-31.

The representations created by Vargas Lugo, however, can neither be indexical, for their referents have not happened yet, nor symbolic, since they refer to specific events and do not operate upon an agreed convention. They refer to those four eclipses, at most, in an *iconic* way, resembling certain visual features that we know in advance they will possess when occurring.[387] Hence, if their referents have not yet existed, isn't that the very definition of the simulacrum, a sign that precedes its referent?[388] Vargas Lugo *simulates* solar eclipses and makes them present, the "future simultaneous."[389] All this ambiguity and *oscillation* in reference to time, memory, and the future is primarily given by the operation of documented reference to the future and the display of the project through televisions and newspapers.

The use of the news-like brochure (Figures 4 and 5) also relates to our hyper-mediated experience with solar eclipses and its contrast with the scientific account of it, which also produces another dichotomy: on the one hand, the scientific charts provide accurate information on any foreseeable eclipse but, on the other hand, it seems like we relate more to solar eclipses when these are referred to in the media. The scientific information of all the eclipses that we might experience in life is already there but yet, we do not know it on a regular basis. It is almost as if we were satisfied with just knowing that it *is there*, awaiting to be activated in a closer time by its mediation; after all, if a solar eclipse is to happen in the near future, it is not likely that we are going to miss it by any means.

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[387] It is important to note, however, that Peirce's types of signs are not mutually exclusive and they often overlap within specific signs and semiotic situations.

[388] Victor Ieronim Stoichita, *The Pygmalion Effect: from Ovid to Hitchcock* (Chicago: University of Chicago Press, 2008), 3.

[389] "Sun," 18.

It is true that the scientific charts with the list of solar eclipses already predicted calls our attention to the future and the predictability of the event. However, I conceive of this rhetorical response as more self-reflective on what this predictability means. Am I going to still be living by then? Will I be here for the next solar eclipse? Or, as Vargas Lugo states in the interview presented in the *Sun* brochure, "will Texas exist as Texas?"[390]

The idea of prediction is strongly related to the decline of any symbolism in solar eclipses, not only because the event is no longer contingent or cataclysmic,[391] but because their contemporary prediction complies with the scientific belief about the material world as independent from any human observation and meaning. As Vargas Lugo explains in the artistic statement for the project: "As with other natural phenomena, the depth of our understanding of these events goes in direct proportion to their loss of mythical sheen."[392]

Response V: Symbolism

Eclipses, as I have discussed in previous chapters, are ambiguous events that transit between astrophysical explanations, mysticism, religion, and superstition. However, at first sight, it seems that in both the scientific enunciation of solar eclipses, as well as in Vargas Lugo's piece, there is an obliteration of the symbolic/mystic dimension of the event. Although in the gallery label, the official project description, and the artist's statement there is an acknowledgment of *mystical* interpretations of eclipses, the installation appears to circumvent this mysticism. For instance, the gallery label reads: "An eclipse on May 28, 585 CE ended a war

[390] Ibid.

[391] Since eclipse mapping methods date back to ancient cultures like Egyptians, Maya, Aztec, etc. See, for instance, Bhatnagar and Livingston, *Fundamentals of Solar Astronomy* (Hackensack, NJ: World Scientific, 2005).

[392] Vargas Lugo, "WorkSpace 11: Pablo Vargas Lugo, *Eclipses for Austin.*"

between the Lydians and the Medes, who stopped fighting when day was turned to night and subsequently agreed to a peace treaty."[393] The official project description reads in a similar tone: "In ancient times, and in some cultures today, solar eclipses have been attributed to supernatural causes."[394] Nonetheless, the presentation of the performances on the screens and in the *Sun* brochure offers little or no acknowledgement of these *ancient mysticisms*.

In science, this circumvention of meaning is given because it is not part of the scientific concern; it is a purposeful omission that complies with the axiomatic idea that knowledge exists without meaning. At first, I thought this feature was a shared aspect between science and Vargas Lugo's work, but the artist's statement, as well as my personal interviews with him, made me realize that he is indeed drawing attention to meaning. In his statement, Vargas Lugo suggests:

> I'd argue that eclipses keep the power of unsettling our most cherished expectations. Eclipses have thus turned into the greatest natural spectacle available to humankind. More than any other astronomical event, they generate expectation and buzz; people travel to see them and collect memorabilia, making the experience of an eclipse one of the highlights of their lives.[395]

Thus, once again, Vargas Lugo highlights the personal, bodily experience of solar eclipses, drawing attention to the individual experience, memory, astonishment, the idea of the cosmic spectacle, and its collective convocations. This is the specific meaning to which *Eclipses for Austin* is directing our attention. Furthermore, mystical/religious meaning in the actual

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[393] Blanton Museum of Art, "*Eclipses for Austin*" (Gallery label, Blanton Museum. 2009).

[394] Blanton Museum of Art, "Pablo Vargas Lugo: *Eclipses for Austin*" (Project description, Blanton Museum, 2009), 2.

[395] Vargas Lugo, "WorkSpace 11: Pablo Vargas Lugo, *Eclipses for Austin.*"

installation is addressed reticently, as the author notes in the interview in the final pages of *Sun*: "Will it look like sun worshipping?"[396]

Vargas Lugo's work focuses on the meaning described above due to the fact that, in general, solar eclipses are experienced differently in contemporary societies (not all of them) based on the way our knowledge of the event is constructed by science. In other words, given that our understanding of solar eclipses is shaped primarily by science, our relationship to the event now takes a different form, away from magic, but still close to astonishment and joy; away, probably, from religion, but still akin to sport events and spectacles. This is how the artwork operates, in Vargas Lugo's words, as a "collective ritual, a reverse commemoration of events."[397]

Solar eclipses, as suggested by the work, do not lack meaning, but the latter is shaped, and changes accordingly, in relation to our understanding of the phenomenon. The meaning that the work draws attention to is a sense of bodily experience, of reflection, of memory and future, of collective experience and individual amazement; however, this meaning, as I said, varies and is mobile. In this regard, and summarizing this idea, the artistic statement, as well as the project description feature the following Mark Twain's quote: "An occultation of Venus is not half so difficult as an eclipse of the sun, but because it comes seldom the world thinks it's a grand thing."[398]

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[396] "Sun," 18.

[397] Vargas Lugo, "WorkSpace 11: Pablo Vargas Lugo, *Eclipses for Austin.*"

[398] Ibid.

Chapter Summary

In this chapter, I have applied the rhetorical methodology of Bitzer's rhetorical situation to identify and describe the elements of exigence, constraints, and the fitting response that are present in the specific rhetorical situation addressed by *Eclipses for Austin* by Vargas Lugo. The exigence, or need, is given by the *incomplete* account that science, astronomy, and astrophysics in particular, provide in regard to solar eclipses, as well as the apparent dichotomic polarization between this account and our personal bodily experience with the phenomenon. The work of art comes into being as a response to this exigence, as well as a culmination of the artist's personal inquiry into and interests in solar eclipses, scientific representation, memory, time, future, and mediatization.

The exigence entails several constraints that limit and shape the situation. I have identified two different types of constraints as coming from the nature of scientific inquiry, or the art world. The scientific constraints are primarily constituted by the axiomatic tenets that most sciences share and that *limit* their inquiries and conceptions of the world. These constraints comprise the following scientific ideas about solar eclipses: 1) that eclipses are the result of astronomical mechanisms, which are understood by their mathematical dimension; 2) that eclipses are determined by these mechanisms and, therefore, can be predicted and postdicted with accuracy; 3) that eclipses lack meaning beyond their mechanical operation; and 4) that knowledge of solar eclipses is universal and shared throughout humanity. Additionally, for astronomy and astrophysics, after eclipse-mapping methods are set and commonly accepted, solar eclipses are conceived of as tools to perform further scientific tests on gravity variation, chemical components, relativity, and the like, constituting also a final scientific constraint. In this

rhetorical situation, the work of art either responds to or seizes these constraints as they operate as limitations as well as possibilities that enable the fitting response.

With regard to the fitting response in this situation, I have identified five discourses that emerge from the work of art that directly address the exigence and, ultimately, expand on scientific knowledge of solar eclipses. These responses are summarized as follows:

- *Collectiveness*. The work emphasizes the collective experience of solar eclipses by creating the images through cart-stunt performances (a collective technique), addressing the massive mediatization of the event and resembling the power of convocation that the event often entails.
- *Location and Particularity*. Solar eclipses are often listed in endless charts that appeal to universalities and generalities. The work of art, conversely, focuses on four specific future eclipses and a specific geographical area, from which the eclipses will be observed. The work also stresses particularity by presenting different perspectives on the images of the eclipses, both in stills and in video, as well as the differences of their umbral paths as they will cross the territory of Texas.
- *Temporality and Duration*. The work vindicates the specific temporality of each eclipse by stressing its duration. This is achieved through the use of audiovisual elements provided by the video and the *soundtrack* composed specifically for the artwork. This response, similarly to the previous one, also draws attention to particularity and difference.
- *Memory of the Future*. The work presents the interplay of dichotomies in which the event is immersed. Solar eclipses are both stunning and *buzzing* events, as well as predictable, foreseeable natural phenomena. The knowledge of any past and future

eclipse is detailed in scientific charts of the event but, at the same time, we experience it more vividly when it is mediated and becomes an expected event experienced by the collective. In this regard, too, the artist proposes a work that serves both as a prediction, a simulacrum, as well as a *dated* work of art that will change its meaning eventually as the four eclipses occur.

- *Symbolism*. This final response focuses on the contemporary individual and collective meaning that we invest onto solar eclipses. Science prescribes the lack of meaning in natural events and processes, whereas Vargas Lugo draws attention to the construction of social and personal meaning of solar eclipses through bodily experiences, the memories, the reflections, etc., thus, highlighting the nature of a highly meaningful event.

Through these responses, the work of art draws attention to aspects of solar eclipses that are either disregarded or perceived as secondary in the scientific account of the phenomenon, thus providing an expanded, more located and specific understanding of the issue as a social event. The work of art operates as a rhetorical artifact that generates certain discourses and, by doing so, enables an expansion of our knowledge and understanding of, in this case, solar eclipses. The work, as stated by curator Dávila-Villa, makes you think extra-artistically, asking us to go beyond the aesthetic to delve into other realms.[399]

[399] Dávila-Villa, interview.

CHAPTER 5:

DISCUSSION AND IMPLICATIONS

For this final chapter, I will consider the analysis I have performed in the previous chapter to revisit my research questions as stated in Chapter 3 and attempt to answer them directly. I will also reflect upon the use of rhetorical criticism to analyze contemporary art. Finally, I will draw my final conclusions on this analysis as well as consider the broader implications of my findings and make suggestions for future research.

Research Questions Revisited

In Chapter 3, I posed my research questions as well as described my methodology for analyzing Vargas Lugo's work. A culmination of my thesis requires a reflection upon these questions, which propelled my study: What are contemporary artistic practices generating when they rearticulate scientific means of knowledge production and enunciation? What rhetorical discourses emerge from these practices as a response to expand upon scientific knowledge? I will address these two questions individually in the following subsections.

Rearticulation of Scientific Knowledge

Although artists are even more involved in collaborative projects and research settings, artistic-oriented research and science are still dissimilar, thus generating uneven conditions for a smooth collaboration with equal expectations from both sides. In fact, this very thesis, because of its topic, which falls between the cracks created where several disciplines collide, has been subject to different expectations and dissidences between the people who helped me bring it to fruition.

Eclipses for Austin exemplifies these situations, since the original idea of the artist was to collaborate more closely with the astronomy department at the University of Texas.[400] Given this situation, one of the main strategies used by contemporary artists to create *bridges* between art and science is the appropriation and rearticulation of the knowledge provided by the latter.[401]

Appropriation, as explained in Chapter 4, is an artistic maneuver that was popularized in the 1970s and the 1980s, often related to image copying and imitation.[402] However, in works like Vargas Lugo's, what is being appropriated is knowledge. This gesture, however, might go unnoticed given the scientific belief on a collective ownership of knowledge,[403] an idea that prescribes that scientific knowledge is discovered, not produced, thus public as opposed to private.[404]

To answer my question about what do contemporary artistic practices generate when they rearticulate scientific knowledge, through appropriation, I performed my analysis on the

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[400] Pablo Vargas Lugo, interview by C. Rodrigo Guzmán, August 2012, interview A, transcript.

[401] The exchanges between experts from different disciplines and their communication/translation of expertise to the general public is addressed in articles like Harry M. Collins and Robert Evans, "The Third Wave of Science Studies: Studies of Expertise and Experience," *Social Studies of Science* 32, no. 2 (2002): 235-296.

[402] Sherri Irvin, "Appropriation and Authorship in Contemporary Art," *The British Journal of Aesthetics* 45, no. 2 (2005), 124.

[403] Georg Franck, "Scientific Communication--A Vanity Fair," *Science* 286, no. 5437 (1999), 53.

[404] A recent example of a similar scientific appropriation in an artistic project is the installation *Étude taxonomique-comparative entre les Castes de la Nouvelle Espagne et celles du Mexique Contemporain* [Taxonomical and Comparative Study Between the Castes of New Spain and those of Contemporary Mexico], from 2010, by Mexican artist Erick Meyenberg, in which he used knowledge from the Mexican genome project to trace the percentages of African, Spanish and Indigenous blood in the constitution of the contemporary Mexican population.

discourses from which they emerge. Nevertheless, before detailing the specifics on how these discourses expand our knowledge and understanding of certain topics, it might be useful to conclude that these artistic practices generate discourses that juxtapose and integrate both systems of production and meaning making. When contemporary artist retake science to use in their artworks, they ask us to think about issues in novel ways and to reflect on the validity and authority of scientific knowledge alone. They make us think, not only on what we know, but how we know it; they reflect on knowledge itself.

Also, the artworks that arise from this premise tend to transcend, in a way, the constraints of both science and art in order to construct a new realm of cognition and experience, a realm in which we are provoked and asked to reflect, remember, make connections and, furthermore, expand our understanding of the world. In making this provocation, almost like incitement, these artworks require us to compare and collate different *worlds*, i.e., different accounts of reality—the world of science, of art, of sports, of family, of memory, of the future, of media, etc.

Discourses as Rhetorical Response

If art is understood as a rhetorical response to a situation, several discourses can be *read* and analyzed from *Eclipses for Austin*. These discourses constitute the fitting response in Bitzer's rhetorical situation. In general, contemporary artistic practices that expand our knowledge or understanding on a specific subject and that depart from the scientific account of it, do so through two closely related actions. First, they draw attention to aspects absent in the scientific perspective and, secondly, they emphasize those aspects that are usually regarded as secondary or that do not stand out in science. The first action generates discourses on elements previously absent in science; these elements should be analyzed in each specific case, since different artworks address different things. In the case of Vargas Lugo's work, this discourse

constitutes the focus on the collective, spectacular, experience with solar eclipses. The second action, on the other hand, produces discourses that vindicate what is framed as secondary in science, such as the focus on location and particularity, the timely and bodily experience of a natural event, the reflection on the very tenets of science, like predictability and determinism, and the meaning/symbolism that is often discharged from natural phenomena.

These discourses vary, as I said, amongst different artworks but, in general, they depart from a more *located*, subjective encounter with the natural world. In the case of the artwork analyzed here, I identified, for example, that the artist complies with Haraway's concept of *situated knowledge*.[405] Not only is he focusing on geographical and time particularities and acknowledging his agency in the process of communicating the phenomenon, he also departs from the body,[406] from the individual, located experience of solar eclipses beyond its scientific understanding and appeals to self-reflection, memory, meaning, and amazement. As curator Dávila-Villa explains, the artwork makes you think about all these aspects of solar eclipses (specific duration, mediatization, the social experience, etc.) but, beyond that, it makes you think where you were during the solar eclipses you have experienced and how you lived them, as well as where and how you will experience the forthcoming ones.[407]

The question whether art can contribute to knowledge, or not, which was a broader point of departure for this thesis, is then addressed through the scrutiny of the rhetoric of knowledge enunciation. In these lines, contemporary art seems to address and disarticulate organized

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[405] Donna Haraway, "Situated Knowledges: The Science Question in Feminism and the Privilege of Partial Perspective," *Feminist Studies*, 14, no. 3 (1988).

[406] Ibid., 582.

[407] Úrsula Dávila-Villa, interview by C. Rodrigo Guzmán, July 2012, transcript.

knowledge, namely science, by drawing attention to what it excludes, to what it cannot include in its account to describe the world, and by highlighting, at the same time, those principles that constrain science to complete its mission of unifying knowledge.

Rhetorical Criticism in Contemporary Art

Classical rhetorical criticism is often related to language; however, contemporary rhetorical criticism offers a broad range of tools from which to approach a diversity of rhetorical artifacts. In this sense, contemporary visual rhetoric is central to my methodology and analysis of contemporary art. The study of visual artifacts,and of fine arts in particular, might be useful in order to focus in on a more individual experience with the art object, thus privileging a focus on the affect and the aesthetic experience over specialized knowledge in, for instance, art history or sociology of art. Sonja Foss explains that,

> Visual rhetoricians are interested in the impact of visual symbols on lay viewers—viewers who do not have technical knowledge in areas such as design, art history, aesthetics, or art education. Lay viewers' responses to visual artifacts are assumed to be constructed on the basis of viewers' own experiences and knowledge, developed from living and looking in the world.[408]

Furthermore, as explained by Foss and Radich,[409] the art object becomes a portal in which the audience enters to discover the artist's perspective of the world. In this sense, and following Helmers in saying that "all artistic production is the result of decisions made by the

[408] Sonja K. Foss, "Framing the Study of Visual Rhetoric: Toward a Transformation of Rhetorical Theory," in *Defining Visual Rhetorics*, ed. Charles A. Hill and Marguerite H. Helmers (Mahwah, NJ: Lawrence Erlbaum, 2004), 306.

[409] Sonja K. Foss and Anthony J. Radich, "The Aesthetic Response to Nonrepresentational Art: A Suggested Model," *Review of Research in Visual Arts Education* (1980), 42.

artist and is created for particular audiences."[410] The artist, then, can be identified as the rhetor in a given situation since, through his or her practice, decisions, and actions, the exigence is addressed, whether expressly or not; at the same time, the rhetor is limited by several operative constraints and formulates a fitting response as a result.

Finally, rhetorical approaches to visual arts might also shed some light on underlying discourse of artistic and visual conventions. In my analysis, I have identified in Vargas Lugo's piece a purposeful decision by the artist to use a collective, pre-cinematographic, systematic way of representing eclipses, thus addressing, through an *incoherent*[411] way to represent the scientific, the solid conventions of the visual conveyance of knowledge. As Kostelnick and Hasset explain, "conventions prompt invention: they rarely standstill. They respond to technology, cultural values and knowledge,"[412] and in so, are rhetorical.

These approaches to art are useful because they offer a broader understanding of the actors and discourses involved in a rhetorical act without the necessity of relating the art object, the artist, or the artistic action to a specific artistic movement, style, form, medium, or even artistic predecessors, which, although present at the moment of the production of the piece, might become secondary in the regular individual experience of the work of art by the audience.

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[410] Marguerite Helmers, "Framing the Fine Arts Through Rhetoric," in *Defining Visual Rhetorics*, ed. Charles A. Hill and Marguerite H. Helmers (Mahwah, NJ: Lawrence Erlbaum, 2004), 68.

[411] See Chapter 4.

[412] Charles Kostelnick and Michael Hassett, *Shaping Information: The Rhetoric of Visual Conventions* (SIU Press, 2003), 2. The authors, for instance, present an example of a scientific diagram that represents, simultaneously, different stages of a plant sprouting, "we understand this is a representation of the life cycle of a plant, not a snap shot of a bunch of plants together." See Kostelnick and Hassett, *Shaping Information*, 7.

Limitations and Future Implications

Finally, to give closure to my thesis, I would like to take a moment to reflect on its limitations and to suggest the ways in which this study could contribute to future thought and research.

My study, as I explained in Chapter 2, did not focus on audience reception, although some personal accounts and testimonies were taken into account as part of the artifact. If art is to contribute to knowledge, a study of how people gain knowledge when experiencing art might be done. This suggested study, however, could take many forms and might not be framed from rhetorical criticism (for instance, if it is approached more ethnographically). Understanding the audience's personal reactions to these artifacts as sources of cognition would be, ideally, a confirmation of what is being proposed in this thesis. However, the reason why I decided not to include the component of an audience analysis, beyond the time constraints and the workload, also relies on the idea that knowledge production does not necessarily mean knowledge consumption. An artist, as well as a researcher, can produce knowledge, and render information to foster understanding on specific subjects but this does not requires *somebody* to learn it in order to exist. In this sense, I agree with Bitzer who himself recognizes that both science and art do not necessitate of an audience in the same sense as a public address does;[413] however, I think that both perspectives, as explained in Chapter 3, do need a rhetorical enunciation (the communication of knowledge in science, the exhibition in art), in order to come into being.

Another limitation of this study, which could represent more of a bias than a limitation, might also lie in my personal relationship with both the artist and the curator. Indeed, my

[413] Lloyd F. Bitzer, "The Rhetorical Situation," *Philosophy & Rhetoric* 1, no. 1(January 1968), 8.

interviews with both have shed light in the issue and had helped me confirm some of my findings; it is also true that they might have shaped the way I experience the artwork myself, thus aligning perhaps with the discourse that the artist wanted to get across with his work instead of a mere analysis of its elements.[414]

Finally, I would like to conclude by pointing out the possible implications of this study for future research. This thesis proposes a way to understand the interaction and relationship between two systems of knowledge production and meaning making that are dissimilar. I think that, with this study, through the emphasis on particularities (both of astronomy and astrophysics on behalf of science, and of contemporary art), outlines a way in which these two accounts of the world interact in order to create a broader, more comprehensive perspective of a specific natural phenomenon, and by doing so, exemplifies the way contemporary art and science, in general, interact with each other.

I think, additionally, that one of the main outcomes of this thesis is the application of rhetorical methodology to contemporary art, which is still scarce. Although contemporary rhetoricians stress the importance of analyzing art from a rhetorical perspective, most research along these lines still focuses on figurative artworks.[415] I think this study is an example of the application of these methodologies to art that, although offering visual representations of nature,

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[414] For example, I might have thought that the failure to participate with the astronomy department at UT forced the artist to reconfigure his work, thus being a result of a failed project and not a response to a specific rhetorical situation.

[415] See, for instance, Marguerite Helmers "Painting as Rhetorical Performance: Joseph Wright's *An Experiment on a Bird in the Air Pump*," *JAC* 21, no. 1 (2001); Marguerite Helmers, "Framing the Fine Arts Through Rhetoric," in *Defining Visual Rhetorics*, ed. Charles A. Hill and Marguerite H. Helmers (Mahwah, NJ: Lawrence Erlbaum, 2004); and Kathaleen Reid, "The Hay-Wain: Cluster analysis in visual communication," *Journal of Communication Inquiry* 14, no. 2 (1990), 40-54.

constructs its discourses on attitudes, decisions, and spatial, temporal and sound elements that generates a complex artifact within a very specific rhetorical situation. After all, as Thierry de Duve states,

> Of course, in order to be progressive – and how could art of any significance not be progressive? – attitude had to be critical. Lukács, Adorno, Althusser and others were called in to tell would-be artists that neither talent nor creativity were needed to make art but, instead, that "critical attitude" was mandatory. And the fact that not just artists but all "cultural workers" were thought to be in need of a critical attitude of course helped to shape a new, strongly politicized discourse about art and its relation to society.[416]

In this sense, the contemporary artistic practices that reformulate and re-enunciate science not only depart from a critical attitude towards the production of knowledge and meaning but, also, they invite us to share of this attitude and question ourselves about the things we know, and the way we know and approach the world.

[416] Thierry de Duve, "When Form Has Become Attitude – and Beyond," in *Theory in contemporary art since 1985*, ed. Kocur, Zoya, and Simon Leung (Malden, MA: Blackwell, 2005), 27.

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"Sun." Brochure to *Eclipses for Austin.* Blanton Museum. 2009.

Vargas Lugo, Pablo. "WorkSpace 11: Pablo Vargas Lugo, *Eclipses for Austin.*" Artistic statement, Blanton Museum, 2009.

APPENDIX: FIGURES

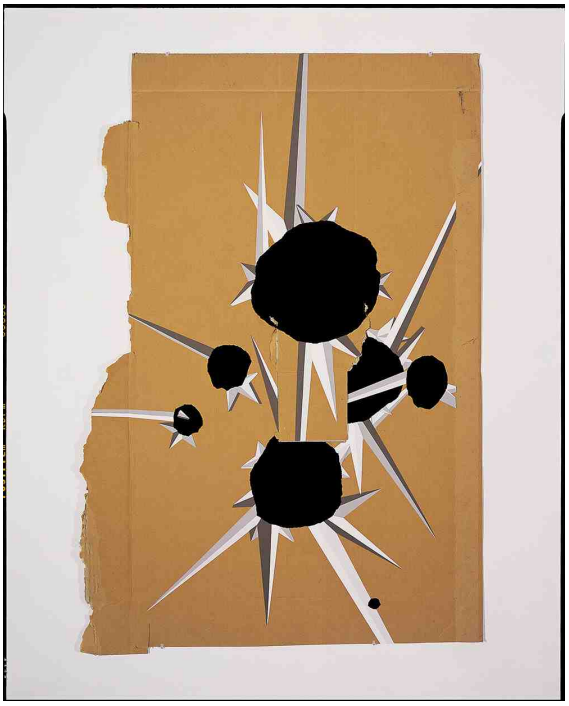
Figure 1. *Eclipses for Austin* (still from video), 2009. Courtesy of the artist.

Figure 2. Eclipses for Austin (still from video), 2009. Courtesy of the artist.

Figure 3. Eclipses for Austin (installation), 2009. Courtesy of the artist.

Figure 4. *Eclipses for Austin* (installation), 2009. Courtesy of the artist.

Figure 5. Eclipses for Austin (installation), 2009. Courtesy of the artist.



Figures 6 and 7. *Sombras para estrellas y algunos eclipses*, 2007-08. Courtesy of the artist.

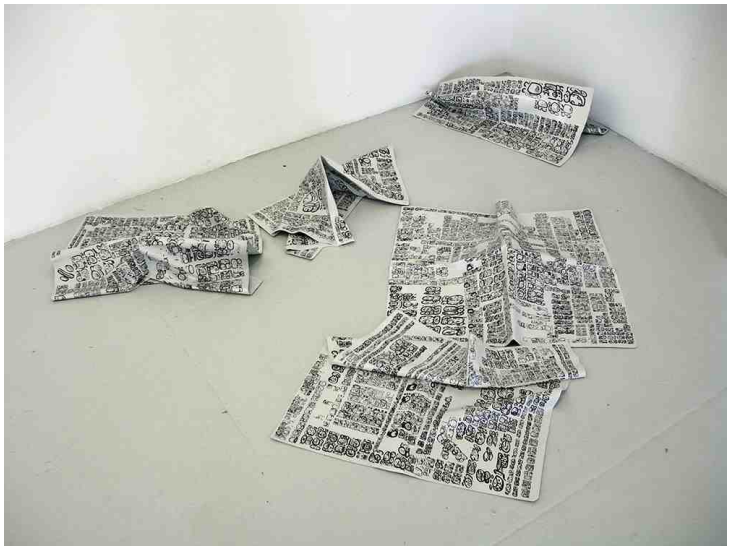
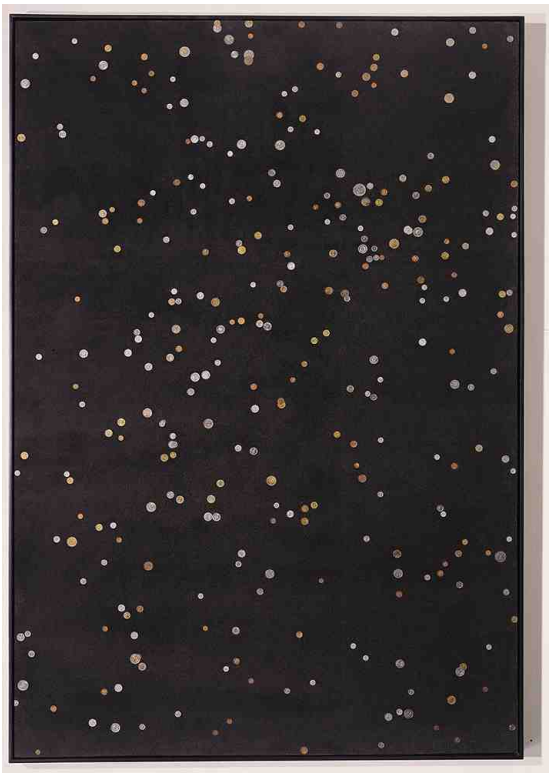


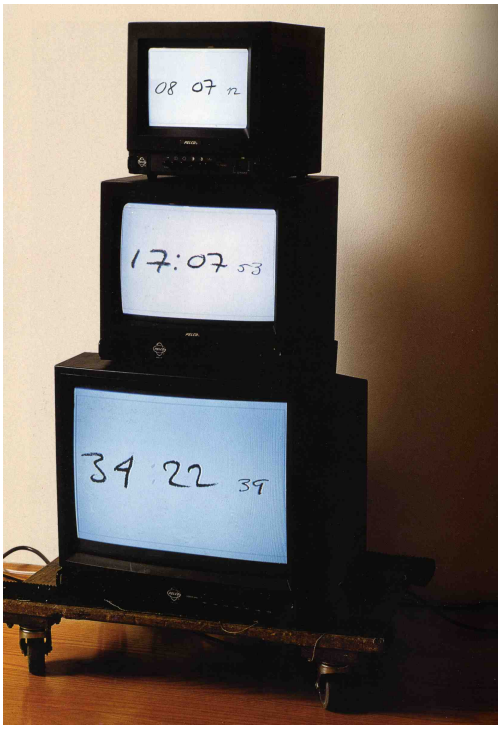
Figure 8. Bonampak News, 2005-06. Courtesy of the artist.



Figures 9 and 10. *Serie Fortuna*, 2008. Courtesy of the artist.

Figure 11. *Serie Fortuna* (detail), 2008. Courtesy of the artist.

Figure 12. *Intemperie*, 2012. Courtesy of the artist.



(left to right) Figure 13. *Reloj I*, *II* and *III*, 2003; and Figure 14. *Trayectoria de eclipses*, 2009. Courtesy of the artist.

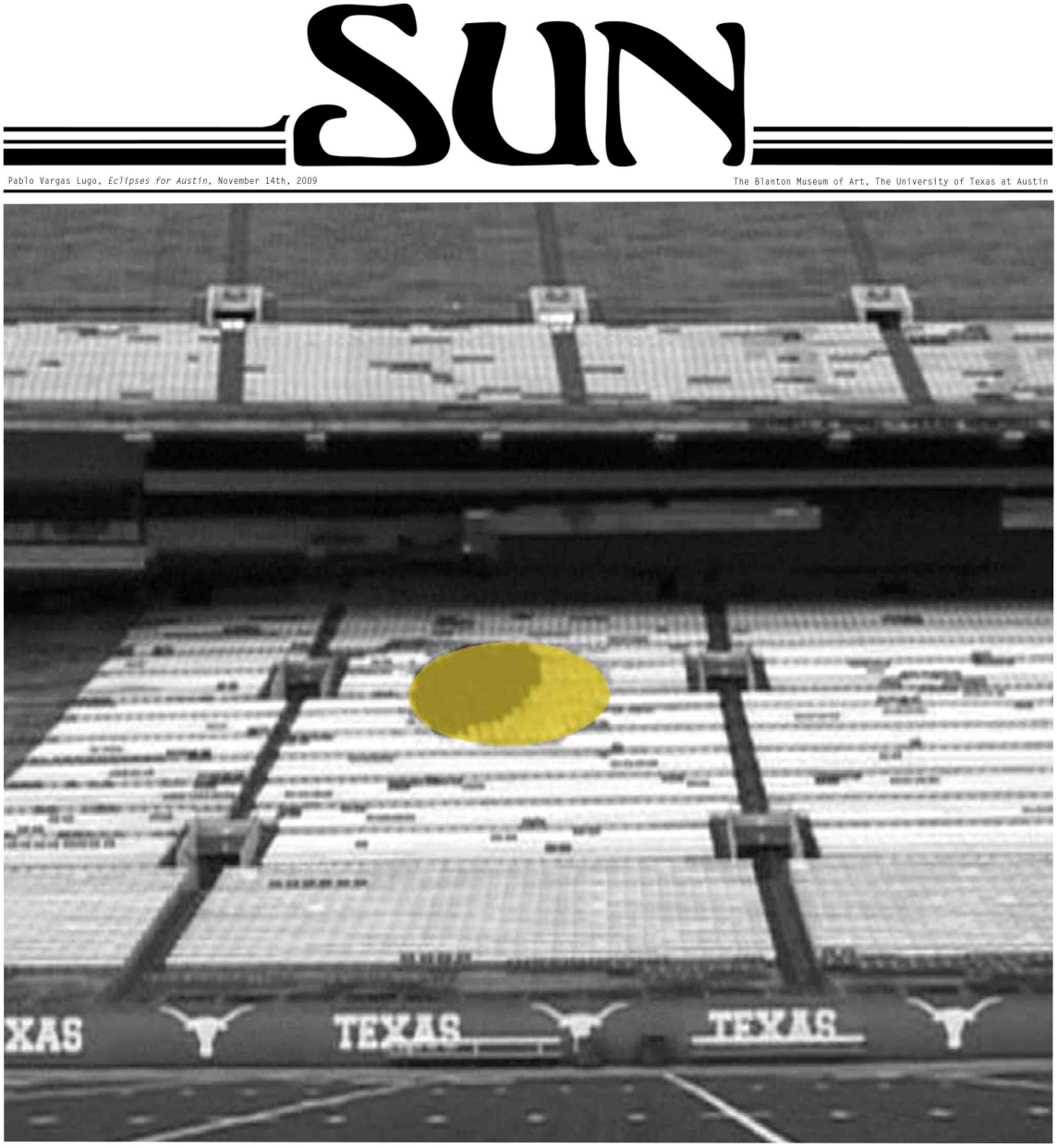


Figure 15. *Sun* (brochure), Cover, 2009. Courtesy of the artist.

Eclipses visible from the city of Austin, Texas. 2010-3000 CE.

Type indicates annular (A), hybrid (H),partial (P) or total (T) eclipse. Duration indicates length of eclipse maximum.

Date	Type	Duration	Date	Type	Duration
+2012 May 20	A	05m46s	+2139 Jul 25	A	02m13s
+2014 Oct 23	P		+2143 May 14	A	01m05s
+2017 Aug 21	T	02m40s	+2144 Oct 26	T	04m05s
+2023 Oct 14	A	05m17s	+2146 Mar 12	A	00m03s
+2024 Apr 08	T	04m28s	+2151 Jun 14	T	03m48s
+2028 Jan 26	A	10m27s	+2153 Oct 17	T	04m36s
+2029 Jan 14	P		+2154 Apr 12	A	05m42s
+2031 Nov 14	H	01m08s	+2158 Jul 25	T	03m32s
+2033 Mar 30	T	02m37s	+2159 Jan 19	A	
+2038 Jul 02	A	01m00s	+2160 Jun 04	T	02m58s
+2040 Nov 04	P		+2165 Sep 05	A	07m22s
+2045 Aug 12	T	06m06s	+2169 Jun 25	T	03m58s
+2046 Feb 05	A	09m42s	+2172 Oct 17	H	01m34s
+2048 Jun 11	A	04m58s	+2176 Feb 10	A	01m34s
+2052 Mar 30	T	04m08s	+2178 Jun 16	T	02m36s
+2055 Jan 27	P		+2183 Mar 23	T	04m54s
+2056 Jan 16	A	02m52s	+2183 Sep 16	A	07m53s
+2056 Jul 12	A	01m26s	+2184 Sep 04	A	03m12s
+2057 Jul 01	A	04m23s	+2186 Jan 20	A	10m53s
+2066 Jun 22	A	04m40s	+2191 Apr 23	A	00m03s
+2067 Jun 11	A	04m05s	+2193 Aug 26	A	01m45s
+2067 Dec 06	H	00m08s	+2197 Jun 15	A	01m32s
+2068 Nov 24	P		+2198 Nov 28	T	03m58s
+2071 Sep 23	T	03m11s	+2200 Apr 14	T	01m23s
+2077 Nov 15	A	07m54s	+2205 Jul 17	T	04m10s
+2078 May 11	T	05m40s	+2207 Nov 20	T	03m56s
+2078 Nov 04	A	08m29s	+2208 May 15	A	04m19s
+2082 Feb 27	A	08m12s	+2210 Sep 18	P	
+2083 Feb 16	P		+2211 Mar 15	T	02m57s
+2085 Dec 16	A	00m19s	+2212 Aug 27	T	03m45s
+2092 Feb 07	A	01m48s	+2213 Feb 21	A	06m44s
+2094 Dec 07	P		+2218 Apr 25	T	01m43s
+2099 Mar 21	A	07m32s	+2223 Jul 28	T	04m09s
+2099 Sep 14	T	05m18s	+2226 Nov 20	H	00m03s
+2100 Mar 10	A	07m29s	+2230 Mar 15	A	01m40s
+2106 May 03	T	03m47s	+2232 Jul 18	T	01m14s
+2109 Mar 01	P		+2233 Dec 31	T	03m18s
+2110 Feb 18	A	01m12s	+2237 Apr 25	T	06m05s
+2110 Aug 15	A	03m07s	+2238 Oct 08	A	03m47s
+2111 Aug 04	A	05m42s	+2239 Mar 06	P	
+2118 Sep 15	T	03m04s	+2240 Feb 23	A	09m41s
+2121 Jul 14	A	02m32s	+2242 Dec 22	P	
+2122 Jan 08	A	01m02s	+2245 May 26	T	01m30s
+2125 Oct 26	T	03m15s	+2247 Sep 29	A	01m47s
+2131 Dec 19	A	10m14s	+2251 Jul 19	A	02m16s
+2132 Jun 13	T	06m55s	+2252 Dec 31	T	03m34s
+2137 Mar 21	A	01m40s	+2254 May 17	T	02m09s
+2138 Aug 05	P		+2259 Aug 19	T	03m49s
+2260 Aug 07	P		+2421 May 31	A	02m32s
+2261 Dec 22	T	03m17s	+2422 Nov 14	A	08m01s
+2263 Jun 06	T	02m01s	+2425 Sep 12	T	04m47s
+2267 Mar 26	A	06m03s	+2432 Apr 30	T	05m56s
+2269 Jul 29	A	02m35s	+2433 Oct 13	A	02m23s
+2272 May 27	T	02m14s	+2437 Feb 05	A	01m58s
+2273 May 17	T	06m31s	+2443 Mar 31	A	03m02s
+2277 Aug 29	T	03m28s	+2444 Sep 12	T	05m24s
+2280 Jun 27	A	02m45s	+2449 Nov 15	A	07m35s
+2284 Apr 16	A	01m45s	+2450 Nov 04	A	08m30s
+2289 Jan 22	T	03m18s	+2451 May 01	T	03m28s
+2291 May 28	T	06m34s	+2458 Jun 11	T	04m04s
+2292 Nov 09	A	04m14s	+2460 Apr 21	T	01m34s
+2294 Mar 27	A	07m42s	+2464 Feb 07	A	00m31s
+2298 Jan 13	T	02m52s	+2465 Jul 23	A	06m35s
+2299 Jun 28	T	03m03s	+2470 May 01	P	
+2301 Nov 01	A	02m01s	+2472 Sep 03	T	02m19s
+2308 Jun 19	T	02m08s	+2475 Jul 03	A	01m11s
+2312 Apr 07	A	07m00s	+2476 Dec 16	A	10m04s
+2313 Mar 27	A	06m50s	+2477 Dec 05	P	
+2314 Sep 10	A	02m54s	+2483 Feb 07	T	04m20s
+2316 Jan 25	T	02m42s	+2483 Aug 03	A	06m50s
+2245 May 26	T	03m32s	+2484 Jul 23	A	02m10s
+2323 Sep 01	A	03m48s	+2491 Mar 10	A	00m20s
+2324 Aug 20	A	06m33s	+2493 Jul 13	A	00m56s
+2327 Jun 20	T	06m21s	+2497 May 02	A	02m59s
+2339 May 09	A	05m24s	+2498 Oct 15	T	05m21s
+2341 Sep 12	A	04m19s	+2500 Mar 01	H	00m12s
+2343 Feb 25	T	03m06s	+2503 Dec 19	P	
+2345 Jun 30	T	06m07s	+2504 Dec 07	A	09m46s
+2346 Dec 13	A	04m04s	+2505 Jun 03	T	03m50s
+2348 Apr 29	A	05m40s	+2510 Mar 11	P	
+2352 Feb 16	T	02m25s	+2512 Jul 14	T	04m47s
+2355 Dec 04	A	02m02s	+2520 Aug 14	A	01m57s
+2356 May 30	A	02m21s	+2523 Jun 15	T	03m56s
+2365 Dec 13	P		+2526 Oct 07	H	00m40s
+2367 Apr 29	A	04m38s	+2531 Jan 19	A	10m17s
+2368 Oct 12	A	05m13s	+2532 Jan 08	P	
+2371 Aug 11	T	04m36s	+2537 Mar 12	T	04m53s
+2374 Dec 04	T	03m42s	+2537 Sep 05	A	07m11s
+2378 Mar 29	T	04m51s	+2538 Aug 25	A	01m52s
+2378 Sep 22	A	06m54s	+2545 Apr 12	H	01m17s
+2389 Feb 26	A	02m55s	+2548 Feb 10	A	03m23s
+2390 Aug 11	T	04m41s	+2551 Jun 05	A	02m55s
+2393 Jun 10	A	05m34s	+2552 May 24	A	08m09s
+2395 Oct 14	A	06m07s	+2552 Nov 17	T	04m42s
+2397 Mar 29	T	03m11s	+2554 Apr 03	T	00m56s
+2399 Aug 02	T	05m14s	+2558 Jan 20	P	
+2401 Jan 14	A	03m00s	+2559 Jan 09	A	09m43s
+2406 Mar 20	T	02m03s	+2559 Jul 06	T	03m55s
+2410 Jan 05	A	01m31s	+2561 Nov 08	P	
+2410 Jul 02	A	03m25s	+2563 Apr 24	T	01m49s
+2411 Jun 21	A	05m46s	+2564 Apr 12	P	
+2418 Aug 02	T	03m50s	+2566 Aug 16	T	04m47s
+2420 Jan 15	P		+2569 Jun 15	A	02m56s

Figure 16a. *Sun* (brochure), p. 1, 2009. Courtesy of the artist.

Date	Type	Duration
+2571 Nov 18	P	
+2573 Apr 03	T	05m13s
+2575 Sep 05	P	
+2577 Jul 16	T	03m47s
+2580 Nov 08	A	01m15s
+2584 Aug 26	T	04m43s
+2585 Feb 20	A	09m11s
+2586 Feb 09	P	
+2591 Apr 14	T	05m19s
+2592 Sep 26	A	01m42s
+2596 Jul 16	A	02m00s
+2598 Nov 19	A	01m57s
+2599 May 15	T	02m56s
+2602 Mar 15	A	03m41s
+2606 Jun 27	A	06m52s
+2606 Dec 21	T	03m50s
+2608 May 06	P	
+2613 Feb 11	A	08m00s
+2614 Jul 28	A	02m21s
+2615 Dec 12	P	
+2617 May 26	T	03m30s
+2618 May 16	T	03m24s
+2619 Sep 30	P	
+2624 Jul 07	A	06m24s
+2625 Dec 21	P	
+2627 May 07	T	05m22s
+2629 Oct 08	T	02m10s
+2634 Dec 12	A	03m19s
+2638 Sep 29	T	04m31s
+2639 Mar 26	A	07m58s
+2640 Mar 14	P	
+2641 Jul 30	A	03m20s
+2645 May 17	T	05m17s
+2646 Oct 30	A	01m38s
+2652 Dec 22	A	03m56s
+2656 Apr 16	A	04m00s
+2657 Apr 06	A	07m38s
+2661 Jan 22	T	03m04s
+2664 May 17	T	04m02s
+2667 Mar 16	A	05m36s
+2668 Aug 29	A	03m59s
+2670 Jan 13	P	
+2671 Jun 28	T	05m07s
+2672 Jun 17	T	04m36s
+2673 Oct 31	P	
+2678 Aug 09	A	05m30s
+2680 Jan 23	A	02m46s
+2681 Jun 08	T	04m54s
+2683 Nov 10	T	02m49s
+2689 Jan 13	A	04m52s
+2690 Jun 28	T	05m00
+2692 Oct 31	T	04m23s
+2693 Apr 27	A	07m12s
+2694 Apr 16	A	04m05s
+2695 Aug 31	P	
+2696 Aug 19	A	05m24s
+2699 Jun 19	T	04m38s
+2706 Feb 05	P	
+2711 May 09	A	07m05s
+2718 Jun 20	T	03m34s
+2719 Dec 03	T	03m01s
+2721 Apr 18	A	03m17s
+2722 Oct 02	A	06m13s
+2725 Jul 31	T	05m57s
+2733 Aug 31	A	00m49s
+2740 Oct 12	A	06m59s
+2741 Oct 01	A	06m14s
+2743 Feb 16	A	05m20s
+2744 Jul 31	T	05m59s
+2746 Dec 04	T	04m15s
+2747 Nov 24	T	03m49s
+2748 May 19	A	02m53s
+2750 Sep 22	A	05m40s
+2751 Mar 19	T	02m38s
+2758 Apr 29	T	03m18s
+2760 Mar 09	P	
+2765 Jun 10	A	07m02s
+2772 Jul 22	T	02m27s
+2774 Jan 04	T	03m07s
+2775 May 21	A	01m31s
+2782 Dec 26	T	04m10s
+2783 Jun 22	A	07m04s
+2793 May 31	A	01m06s
+2795 Nov 03	A	08m26s
+2797 Mar 20	A	05m00s
+2798 Sep 02	T	06m14s
+2805 Apr 20	T	02m46s
+2809 Feb 05	H	00m06s
+2809 Aug 02	A	03m58s
+2812 May 31	T	04m36s
+2820 Jul 01	A	01m24s
+2822 Nov 04	A	06m49s
+2826 Aug 24	H	01m03s
+2828 Feb 06	T	03m15s
+2829 Jun 22	A	00m35s
+2835 Sep 14	T	01m07s
+2837 Jan 27	T	04m02s
+2838 Jul 12	A	01m03s
+2844 Sep 03	H	00m32s
+2849 Dec 05	A	09m51s
+2851 Apr 22	A	04m20s
+2852 Oct 04	T	05m31s
+2859 May 23	T	02m58s
+2863 Mar 10	H	01m21s
+2866 Jul 03	T	04m59s
+2869 May 02	A	04m05s
+2870 Apr 22	A	08m47s
+2871 Oct 05	H	00m30s
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+2885 Jul 03	T	07m11s
+2889 Oct 15	H	00m02s
+2891 Mar 01	T	03m58s
+2892 Aug 13	A	00m08s
+2896 Jun 02	A	02m42s
+2898 Oct 06	A	01m13s
+2904 Jan 08	A	09m24s
+2905 May 25	A	03m39s
+2906 May 14	A	07m41s
+2910 Mar 02	T	02m15s
+2914 Jun 15	A	02m52s
+2917 Apr 12	T	02m48s
+2918 Apr 02	T	03m55s
+2919 Aug 17	P	
+2920 Aug 05	T	04m48s
+2924 May 24	A	07m02s
+2925 Nov 07	A	01m08s
+2927 Mar 24	T	03m54s
+2929 Aug 25	T	03m37s
+2931 Jan 09	A	06m52s
+2935 Oct 18	A	06m59s
+2937 Apr 02	P	
+2938 Aug 16	T	04m42s
+2939 Aug 06	T	06m33s
+2941 Jan 18	P	
+2943 Nov 18	A	01m48s
+2945 Apr 03	T	03m50s
+2946 Sep 16	H	00m23s
+2950 Jul 06	A	03m25s
+2952 Nov 08	A	03m18s
+2957 Feb 20	A	09m28s
+2958 Feb 09	A	07m33s
+2964 Apr 03	T	02m13s
+2967 Jan 31	A	05m55s
+2968 Jan 20	H	00m29s
+2968 Jul 16	A	03m48s
+2971 May 15	T	04m27s
+2972 May 04	T	04m40s
+2978 Jun 26	A	05m12s
+2979 Jun 15	A	01m39s
+2979 Dec 10	A	03m07s
+2980 Nov 28	P	
+2981 Apr 25	T	03m36s
+2983 Sep 27	T	04m36s
+2990 May 15	T	04m58s
+2991 May 05	P	
+2992 Sep 17	T	04m16s
+2993 Sep 07	T	05m33s
+2996 Jul 06	A	04m44s
+2997 Dec 20	A	03m40s
+3000 Oct 19	H	00m29s

Next ten total eclipses whose umbral path will cross over any point of the current territory of Texas.

+2024 Apr 08	+2200 Apr 14
+2045 Aug 12	+2205 Jul 17
+2052 Mar 30	+2245 May 26
+2078 Nov 04	+2245 May 26
+2198 Nov 28	+2343 Feb 25

Future eclipses performed on October 6th, 2009 as seen from the Darrel K. Royal-Texas Memorial Stadium:

April 8th, 2024
April 14th, 2200
July 17th, 2205
February 25th, 2343

Figure 16b. *Sun* (brochure), p. 2, 2009. Courtesy of the artist.

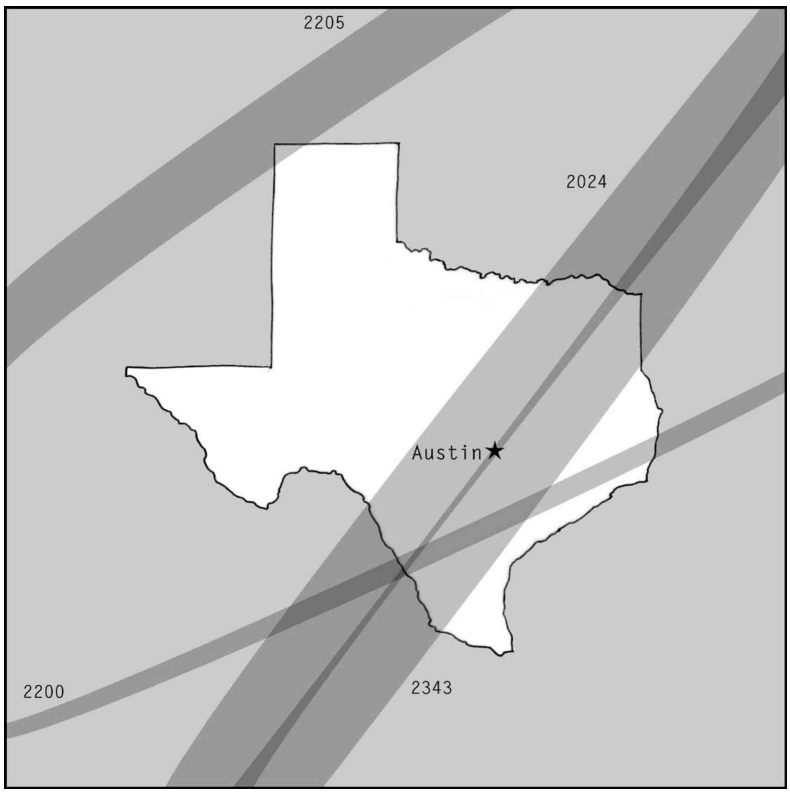

Figure 17. *Sun* (brochure), p. 3 (page detail), 2009. Courtesy of the artist.

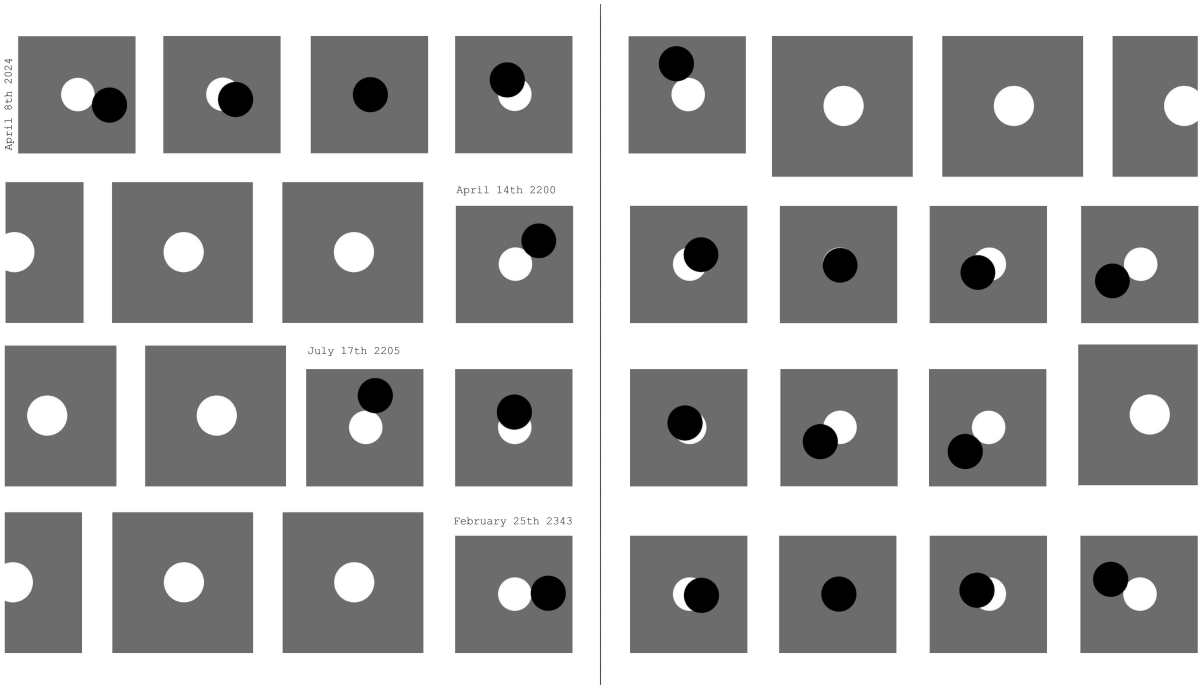

Figure 18. *Sun* (brochure), p. 5 and 6, 2009. Courtesy of the artist.

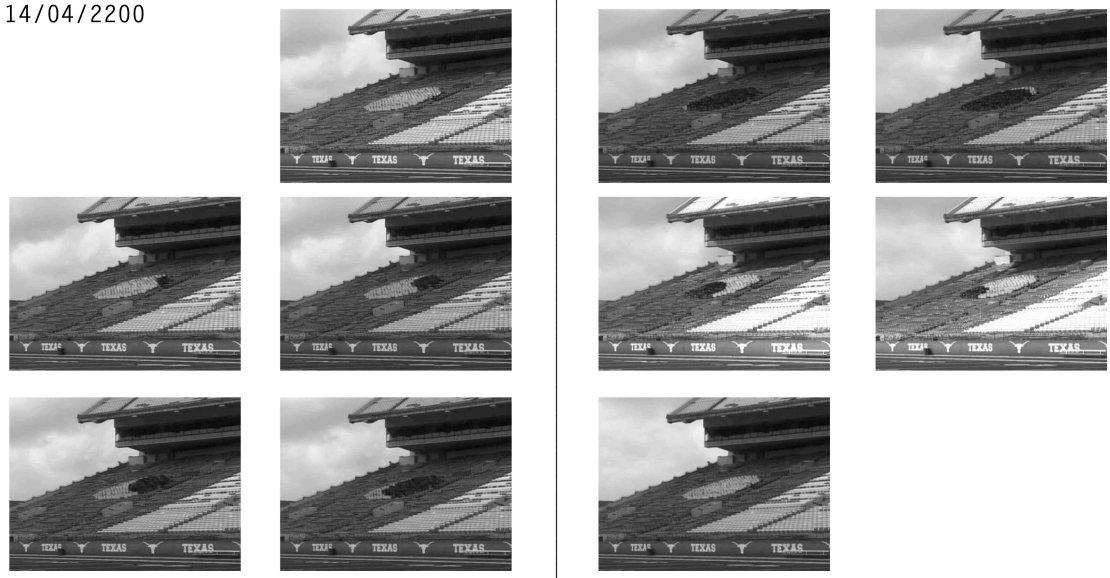

Figure 19. *Sun* (brochure), p. 11 and 12, 2009. Courtesy of the artist.

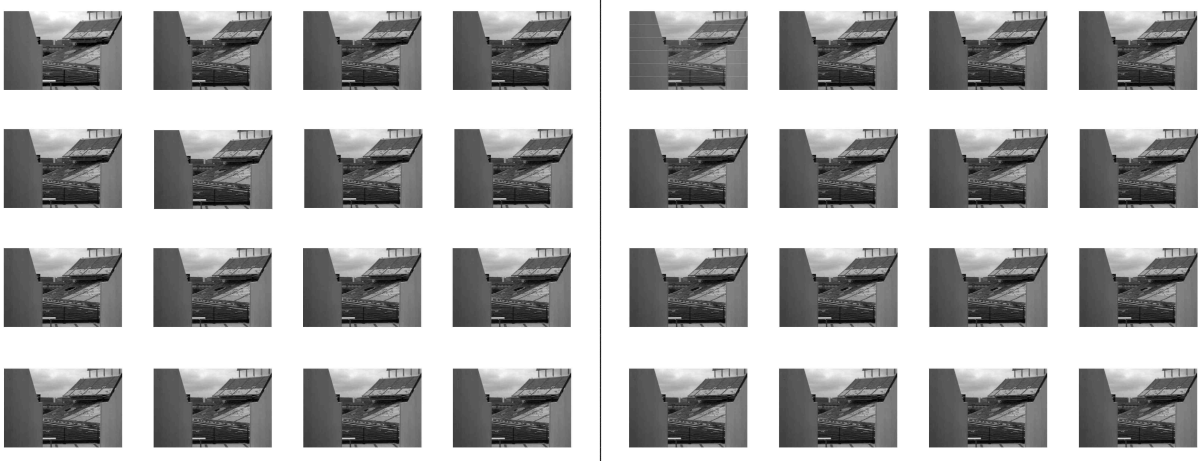

Figure 20. *Sun* (brochure), p. 15 and 16, 2009. Courtesy of the artist.

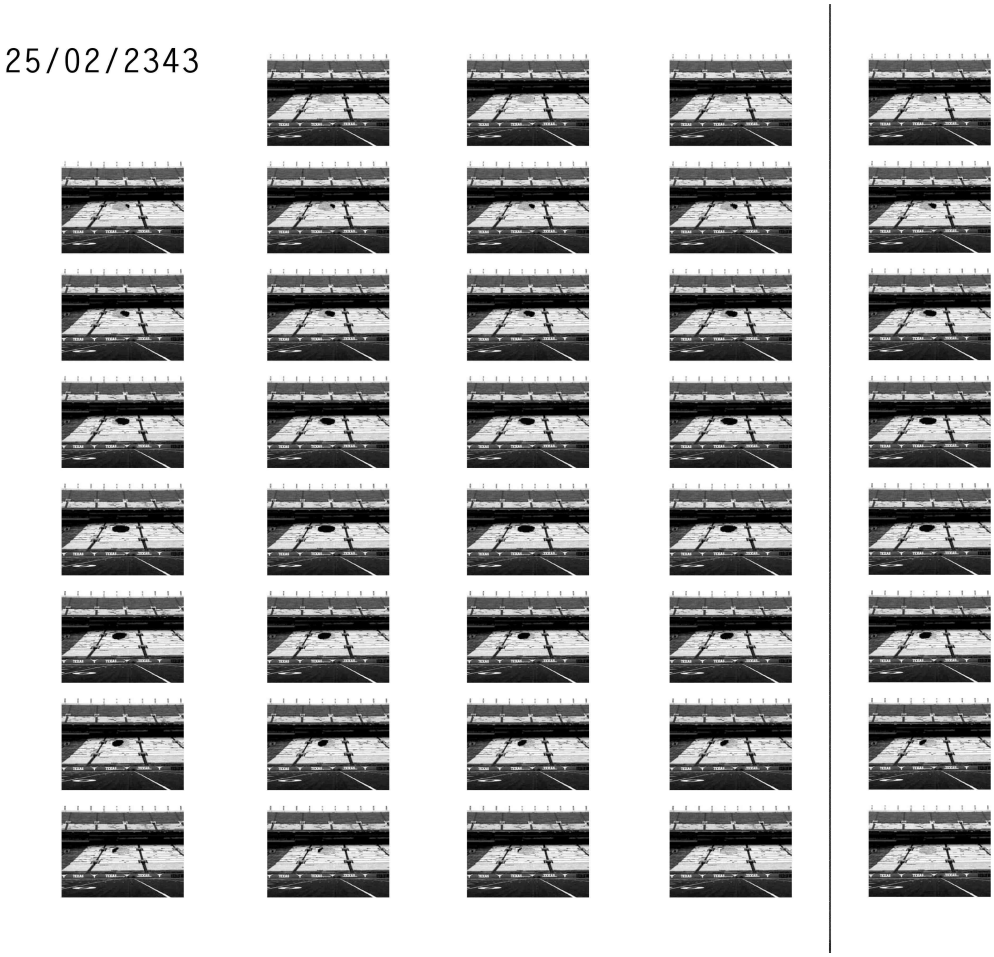

Figure 21. *Sun* (brochure), p. 17 and 18 (page detail), 2009. Courtesy of the artist.