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The Sound in the Museum

Howard Meltzer
City University of New York

Abstract

In the summer of 2015, the Metropolitan Museum of Art presented an exhibition "Warriors and Mothers: Epic Mbembe Art." Included among the objects was seventeen seconds of looped sound audible throughout the exhibition. The exhibition displayed carvings that were once parts of *ikoro* – large slit drums that had been essential in ceremonial practice of Nigeria's Cross River Province. By placing carvings and sound within the space of a Western art museum, the visitor is subtly encouraged to view these as "art works," dislocated from their function in cultural context. In effect, the museum has exercised cultural colonialism, appropriating objects into a Western construct of art and music.

Keywords: LaGamma, museum, exhibition, music, drum

June 2015: a special exhibition in New York's Metropolitan Museum of Art - "Warriors and Mothers: Epic Mbembe Art." Sixteen objects are displayed; all are figural carvings, the wood of each deeply scarred and weathered. There is a seventeenth object – not visible but audible, a sound loop, a pitched percussion pattern, repeating every half minute or so. Like the carvings, it has a label that I carefully transcribe:

> A large slit drum being performed in 2001 in Nko in the Middle Cross River region, during the Leboku annual agricultural festival. Duration 17 seconds looped. Courtesy Gitti Salami.

The galleries in the Metropolitan Museum are not silent. Visitors converse, their conversations not necessarily directed at the objects presented. The looped sound was an anomaly; the Metropolitan Museum's curators do not routinely provide sound for the galleries. But here sounds had been collected and presented as an artifact among physical objects; the recording became a museum piece.

At the time of my visits to the Metropolitan Museum, three special exhibitions presented recorded sound in addition to objects: "Warriors and Mothers: Epic Mbembe Art", "Sultans of Deccan India, 1500-1700: Opulence and Fantasy", and "China: Through the Looking Glass", all exhibitions of non-Western art. The presence of sound in "Warriors and Mothers" seemed the most problematic. The recorded sound was so short, its repetition so insistent, its connection to the artifacts both distant and immediate. No object that could produce the sound was displayed. Exhibition labels

established that the artifacts antedated the recording. What exactly had been collected and displayed? How was I being asked to look and listen?

The presence of sound in the museum suggested an attempt to contextualize works presented out of context, to sidestep the aesthetic and ethical paradox of moving these objects into a gallery, to facilitate their assimilation into our categories of art and music, an intellectual colonialism persisting after the demise of political colonialism. In the West, we reserve physical spaces for artworks and musical works in our society, consigning them to the museums and concert halls that confer the status of high art. Concert halls and museums are not value-neutral spaces. The objects in the Metropolitan Museum of Art had once resided in spaces designated by their function in their society, spaces that do not necessarily correspond to our museums and concert halls.

When we place artworks and music in spaces within our cities that are not museums or concert halls, we are not asked to attend to them in the same way. Our encounters with art and music in these locations are casual, passing moments in our day. The sculpture in the lobby of an office building, the live music in a store or the recorded music in a restaurant is ancillary to the function of those spaces – visual or aural décor. We have come into the space for a purpose unrelated to the music or art. In these instances, music and artworks have what I have termed a "social presence"; they serve as a marker of status or quietly suggest a particular pattern of behavior. The pianist playing "classical" music in an upscale

department store plays on the association of that music with "culture."

Even within concert halls and museums, spaces define hierarchies of function and relegate artworks in concert halls and music in museums to ancillary roles. In the outer foyer of New York's David Geffen Hall, Richard Lippold's sculpture, *Orpheus and Apollo* hung above concertgoers, but concertgoers only saw Lippold's work in the interval before a performance started and during intermission. The piece was ignored by the public much of the time. David Geffen Hall also houses a gallery for the Vera List Art Project. Relegated to the lower level of the building, viewing the art requires a trip down a flight of stairs from the main public space.

New York City's Metropolitan Museum has a substantial presence in the community's musical culture. Much of that presence resides in silence in the galleries: paintings, sculpture, and minor arts depicting musicians and performance, musical instruments and music manuscripts. As sound, music is present in distinct locations at designated times, for designated purposes. The Metropolitan presents concerts in its auditorium, stating in its annual report for the 2012 – 2013 season: "Concerts and Lectures also engaged in programming to encourage global cultural exchange…and launched an ongoing partnership with the World Music Institute, New York, which works with institutions to foster greater understanding of cultural traditions around the world." (Metropolitan Museum of Art, 2013). The museum shop markets a small collection of compact disks. On weekend

evenings, visitors entering the museum hear chamber music from an ensemble in the Great Hall Balcony Bar.

The formal concerts function much as the artworks presented in galleries – the presentation of fine art. The compact disks in the museum shop serve as both souvenirs and reference tools, displayed along with post cards, mugs, exhibition catalogs, and scholarly volumes. The Western chamber music performed in the Great Hall reflects music and art's social presence as backdrop; we are not required to listen carefully, to remain in place to attend to a complete work. Visitors hear fragments of music in passing, a backdrop to their own thoughts and conversation, much as Lippold's statue was glimpsed in a concertgoer's movements through David Geffen Hall. We are, as it were, guests at a cultural cocktail party.

The Metropolitan Museum collects artifacts having material stability, a permanent presence – objects made of canvas, wood, metal, stone, media are media that persist without constant renewal. Such artifacts embody material stability, a permanent presence, whereas music, performed in the moment, does not. The formal concerts and social presentation of music are not acts of collection *per se*; these are transient events. To be collected, music must be recorded, and that technology enables the presence of music as a stable, recurrent experience in gallery, an experience the museumgoer can repeat on subsequent visits much as she expects to see the same works in the same place.

Western art and music has a history of accommodation to the hierarchies inherent in these varied presentations.

Richard Lippold knew where his sculpture would be placed, the pianist who accepts employment in a store or lounge knows how her performance will be received. This is not the case with works from other traditions. To the extent that we can know the intentions of the unnamed Mbembe creators we can be certain they did not imagine the exhibition of their work in a museum.

This discomfort is not mine alone. S. Vogel, who served as one the Metropolitan Museum's curators of African Art, defined the problem:

> African art provides a useful and particularly sharp instance of the distortion produced by exhibiting in museums objects made for quite different purposes. African art has not been included in art museums long enough for its presence to be accepted unthinkingly. If the audience knows one thing about African art, it knows these objects were never meant to be seen in museum buildings. (Vogel, 1991)

The objects we identify as African artworks arrived in museums through a confluence of economic and political influence. The Museum of Primitive Art opened in New York in 1957 as an independent entity under the sponsorship of Nelson A. Rockefeller; the transfer of the collection took place on May 10, 1969 aided by the Metropolitan's trustee Brooke Astor. Nelson Rockefeller offered this rationale for the inclusion of "primitive" art into the Metropolitan's collection, "the creative expressions of great civilizations in Africa, Oceania, and Pre-Columbian America ranked on a par in

terms of aesthetic value with great art forms of other so-called classical civilizations." (Rockefeller, 1978)

Rockefeller prescribes viewing the objects in the galleries as art, the Metropolitan's website reinforces that prescription. Entering the term "African art" into the Metropolitan's search engine yields 489 objects from the collection. The search includes works created in Africa, Europe, and the Americas, displaying works by Modigliani, Winslow Homer, Walker Evans and Picasso.

That prescription is not universal in the collection and presentation of work from Africa. Like the Metropolitan Museum of Art, New York's American Museum of Natural History has amassed a collection of objects from Africa, but the discipline organizing the collection is different. The Hall of African Peoples is under the purview of that Museum's division of anthropology, and the acquisition of objects in its collection began in the 19th century.[1] The Museum of Natural History apparently acquired many objects directly by financing expeditions. Entering "African Art" in their search engine yields a suggestion – "Do you mean Africa culture?"

J. Clifford mapped the distinction embodied by the two institutions, a museum of art and a museum of social science, as the contrast between "art" – where objects are seen as "original" and "singular" and "culture" where objects are seen as "traditional" and "collective." Move an object from the American Museum of Natural History to the Metropolitan Museum and the work acquires the status of fine art. The website of the American Museum of Natural History labels all the objects as part of the "African Ethnographic Collection;"

there is no admixture of objects from other geographic regions. Clifford writes, "Tribal objects located in art galleries (the Rockefeller Wing at the Metropolitan Museum in New York) or displayed anywhere according to 'formalist' rather than 'contextualist' protocols move in this direction." (Clifford, 1988)

How objects are acquired, displayed and represented conditions our response. We are accustomed to works of Western art acquired through the agency of dealers, art galleries, and auction houses, hung on walls, placed on pedestals, housed in glass vitrines, and accompanied by wall labels presenting scholarly and critical commentary. If we are shown a non-Western work acquired through the same agency and given the same physical presentation and similar scholarly and critical commentary, are we then invited to view it in the same way we view a Western object?

Central to the exhibition is an object curator Alisa LaGamma named "the Metropolitan Maternity Figure", a title that already conveys a particular status derived from the emphasis given to the Museum's ownership and specifies a very specific relationship between the two figures presented by the object. The figure depicts a woman holding a child. According to the wall label, the piece was created sometime between the 15th and 17th centuries in Cross River Province, Nigeria. The established provenance of the object begins in the 1970's, in the aftermath of Nigeria's civil war. Its path to the Metropolitan is quite different from the American Museum of Natural History's acquisition of objects through collection in expeditions. A French art dealer, Hélène Kamer

acquired the figure from an African dealer based in Togo, O. Traoré. She exhibited the carving in her Paris gallery in 1974 where it found an unnamed buyer. (LaGamma, 2013) A large-scale photograph in the exhibition reproduced the display in the Hélène Kamer's gallery, reinforcing the objects' status as artworks acquired through the Western art market. A. LaGamma reported the details of the acquisition in the Metropolitan Museum's journal. The Metropolitan Museum acquired the figure in 2010 through the auction house Christie's, a firm noted for its sale of major Western artworks.

The acquisition of the figures in the exhibition demonstrates in microcosm an entire history of Western domination through technology – the availability of oceanic travel and weaponry that facilitated the trading of slaves and the colonization of West Africa. This "superior" technology allowed Westerners to control the flow of people and objects without the necessity of reciprocal benefits. We could ask if the imbalance persists into the present; A. LaGamma writes "The nineteenth-century colonial occupation of the region by Britain marked an end to the slave trade as well as to certain indigenous religious practices." (LaGamma, 2013) The carvings have acquired an exchange value that does not necessarily benefit the descendants of their creators; the carvings are simply another resource available for export.

The figures are not only physically detached from their original context as part of a larger object; they have been detached from the social and spiritual significance as well. The looped sound is a reflection of that detachment. A. LaGamma noted that "indigenous religious practices" had

come to end. Presumably, the sounds presented to us had some relationship to the objects on display. The connection may be more tenuous, though the path by which the recording arrived at the Metropolitan is morally less fraught.

During field research in 2001, art historian G. Salami observed and described the Leboku festival in 2001, collecting photographic images and sound recordings. (Salami, 2008) As stated on the wall label in the exhibition, the recording in the Metropolitan is drawn from her scholarly fieldwork, responsibly collected with due respect to the unspecified performer. The ubiquity of playback equipment makes the recording itself equally available to the performers in Nigeria and to visitors to the Metropolitan Museum. The exchange value of seventeen seconds of sound would seem minimal, yet it too has been detached from social and spiritual significance.

What has been substituted for this social and spiritual significance of both music and objects is akin to J. Clifford's claim of a "formalist" reading. In her comments about the acquisition of "the Metropolitan Maternity Figure," A. LaGamma wrote:

> On the reverse side the exposed wood surface is raw from the neck down. Across the rest of what remains of the finished surface, the pronounced vertical grain is in vivid evidence throughout. Erosion has resulted in deeply grooved channels that powerfully define the overall aesthetic, and this weathering has instilled the subject with a heightened quality of endurance and fortitude. (LaGamma, 2013)

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Critical reception of the work follows the path of an established artworld as well. To review the Metropolitan Museum's exhibition, the *New York Times* dispatched their art critic H. Carter, who commented on the acquisition of "the Metropolitan Maternity Figure" for the Museum's permanent collection:

> In a beautiful example acquired by the Met in 2010, a young woman with a toned body and grave oval face holds a child horizontally across her lap; in another, similar image, the child sits upright, echoing the mother's form. You'll find an equivalent of this pose in a 12th-century French carving of the Virgin and Child, sometimes referred to as the "Morgan Madonna," in the Met's medieval galleries. This maternal image embodies a theological type known as the Throne of Wisdom, in which the Virgin serves as the passive support and the child, the active sapient force. In comparable Mbembe images, women seem to be — simultaneously and magnificently — active and passive. (Carter, 2014)

H. Carter's equation of the carving to a representation of the Virgin Mary taken together with A. LaGamma's comments emphasizing formal and material properties of the work ("raw exposed wood," "weathering," "erosion," creating "deeply grooved channels"), properties that are the result of the lack of conservation rather than a reflection of the original intention on the part of the work's maker, channel the viewer's reception of the work in very specific directions. The object is both an abstract shape to be appreciated immediately for its

visual impact; weathering and erosion, damage to the work becomes grounds for appreciation rather than the site of concerns for the age of the work and its fraught path to the pedestal in the museum.   The context is a Westerner's universal perspective, placing it in a Christian context far removed from any plausible worldview of its maker. Would we reverse to comparison from the Mbembe image to the "Morgan Madonna", seeing damage to a medieval European sculpture as a ground for aesthetic appreciation and the figure as an archetype of mother and child rather than as grounded in the Christian faith?

The presentation of both objects and sound in the isolation of a museum reinforces this prescribed view. Consider the architecture and placement of Western works in both museums and concert halls. Art works and musicians are given separate space within the buildings from the audience. The audience does not expect to enter the performing space of the musicians and is expected to keep a respectful distance from the art works. In the installation at the Metropolitan, some of the works were placed in glass cases; others were placed in the open, but guarded by railings and elevated platforms. Views of the carvings were framed much as a proscenium frames the audience's view of musicians. Walls were painted black and the figures were spotlighted, creating strong shadows. Into this space, disembodied sounds are introduced; neither the instrument nor the performer is part of the exhibition.

What has been collected and how it is heard in this setting? The exhibition label identifies the sound source as a

"slit drum"; in her article for the Museum's journal A. Lagamma gives the instrument its Mbembe name, "ikoro." The Western term "drum" gives us a misleading, informal classification. The ikoro is not a drum at all – a term properly applied to instruments with a vibrating membrane, the drumhead. In more formal Western classification, the instrument is an idiophone. The body of the instrument itself vibrates. The distinction is not merely between Western formal and informal nomenclature. J. N. Lo-Bamijoko, a Nigerian musicologist, noted that Igbo musical vocabulary makes exactly that distinction – *Iku* means to strike a hard surface with a beater; *Iti* means to strike a membrane. (LoBamijoko, 1987) The wall label ignores the performer's understanding of his process in producing the sounds heard. J. N. Lo-Bamijoko also pointed out that ikoro is one of a family of instruments; ikoro referring to the medium size drum used by residents of Imo State in Nigeria.

An ikoro produces approximate pitch in the sense that we discern the varying sounds as high or low, but do not equate them to specific pitches within the Western chromatic scale. Wood idiophones have been adopted in Western practice; the most familiar are woodblocks or temple blocks. In these adopted forms, a performer would require several different woodblocks or temple blocks to produce varied pitches. The recording in the Metropolitan Museum's exhibit demonstrated the ikoro's range well; we hear distinct pitches in the loop.

The recording of the single ikoro also reflected the performance practice J. N. Lo-Bamijoko reports: "Unlike

other families of musical instruments, the three sizes of slit drums never play as a family, and musically they do not perform similar functions." (Lo-Bamijoko, 1987) However, she raises an additional issue. Citing a much older work, the 1921 *Among the Ibos of Nigeria*, she writes "Of the largest slit drums, G.T. Basden stated that they 'are not intended to be instruments of music; rather they are used for spreading information, for ceremonial purposes, and at sacrificial festivals'." (Lo-Bamijoko, 1987) What is the relationship between the size of the instrument heard on the tape and the actual size of the instruments separated from the older carvings on display and what was the function of the older instruments? The label on the wall of the Metropolitan Museum of Art suggests that the seventeen seconds we hear is a fragment of a much longer sound experience, a performance at a festival. While it may accurately represent seventeen seconds of some technical capabilities of a slit drum, is it representative of anything more?

If I am invited to look at the object as a sculpture, analogous to a work of Western religious art (a category that is in itself problematic), how am I being asked to hear the accompanying sound? Museums and concert halls share a similar apparent goal – the audience in each is invited, indeed expected to have an aesthetic experience in an apparently value-neutral setting. Both context and acquisition are de-emphasized. In the case of the Mbembe carvings, the viewer is distanced from the possible role of political unrest in the acquisition of the objects. A. LaGamma wrote: "Through these channels, an influx of artifacts from the Nigerian-

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Cameroonian border region commenced, as a result of two phenomena: European art dealers were not traveling to this area because of the Biafran War, and Malians engaged in the art trade during the 1950s and 1960s, having exhausted sources for material closer to home, had continued to seek out artifacts farther and farther east." (LaGamma, 2013) Ironically, one figure carved in the early 20th century might suggest the more recent political struggle – a seated male wearing a bowler hat and carrying a rifle. Despite that presence, the viewer gazes on objects isolated on pedestals, viewed against a neutral background, in the peaceful halls of a museum in a Western city, the only sound is the equally isolated looped recording.

The sound was collected more benignly, but its origin in relation to the figures may be suspect, as unrepresentative of tradition that produced the ikoro with their associated figures as the display itself. G. Salami herself noted that the Leboku festival as performed in 2001 represents a negotiation between the traditions of the participants in the Middle Cross River region and the visitors who attend the ritual. "The elderly priests, some of whom are devout Christians, instead frequently express concern with the constitution of their audiences and often contemplate the effect of the glamour of Yakurr 'traditions' on foreign spectators." (Salami, 2008). What is presented as relating to the objects on display is distant chronologically, potentially distant in intent, and of uncertain relationship to the whole from which it was drawn. Technology, in the form of modern transportation, has brought spectators to the sounds' point of origin, but the

relationship of spectator to the ritual is uncertain. As visitors to the Metropolitan Museum of Art in New York City, we are even further detached from the origins of both sound and objects.

What inferences is the visitor to draw from this sound? H. Carter compared the 15th to 17th century African carving to a 12th century Madonna figure, perhaps I could compare the sound in the museum to a commercial recording of a 16th Century Mass Cycle by a group of professional musicians.   If I listen to a recording of a Mass Cycle, I hear only part of the text for a service, I do not participate in the ritual of the Eucharist.   I hear a contemporary rendition presented as a reconstruction of a sounds heard some five hundred years ago. From my background as a Western music theorist and musicologist, I can frame the context of the music if I wish. If I chose to listen to the work only to admire the ingenuity of its composition or to appreciate the beauty of the voices, I do so deliberately, with some knowledge of the absence of meaning and function. I recognize the work as incomplete and my experience as distant from the use intended by the work's composer.

S. Vogel wrote that the visitor to an exhibition of non-Western works in museums like the Metropolitan Museum of Art knows that the objects on display were never intended for a museum; I hope that the visitor also knows that the sound was never intended for a museum as well.   More than that, I hope that the visitor knows that the sound in the museum is, if anything, even more an incomplete artifact than the carvings, – seventeen seconds of sound detached from all context, an

insubstantial ghost of a practice long silenced. No matter how respectfully intended, the presence in museums and concert halls of objects divorced from all cultural contexts suggests the persistence of intellectual colonialism persisting after the demise of the political.

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[1]From the website of the American Museum of Natural History: "Over 36,000 objects and textiles represent the diverse peoples of Africa. One of the collection's many strengths is the Congo River region. American Anthropologist Frederick Starr joined the missionary/explorer Samuel Verner on a collecting expedition to the Congo from 1905-1906. He collected nearly 5,000 artifacts including musical instruments, shields, baskets, masks, stools and games that have become part of the Museum's collection of material culture from the Congo region. During the American Museum's Congo Expedition (1909-1915), mammalogist Herbert Lang and ornithologist James Chapin collected over 4,500 objects, including carvings made of wood and ivory, incised gourds, bark cloth, metalworking and musical instruments, primarily from the Mangbetu and Azande peoples. Recently acquired objects include earplugs made by the Zulu people of southern Africa and beadwork made by the Maasai people of eastern Africa." Retrieved from http://anthro.amnh.org/africa.

Autopoiesis Illuminated through the Artwork of Turner, Pollock and Ilachinski

Thomas Choinski
Salve Regina University

Abstract

The artwork of Joseph Mallord William Turner, Jackson Pollock and Andrew Ilachinski are shown to reveal the autopoietic characteristics of nature through portrayals of weather, fractal patterns and water flow. Autopoiesis is discussed from the perspectives of art, philosophy and science. A Heideggerian based approach for the philosophy of art is used for qualification. The concepts of emergence, complexity and the edge-of-chaos in complex adaptive systems theory provide the foundational understanding to recognize autopoiesis in the artistic portrayals from the three artists.

Introduction

This paper argues that the complexity seen in the art of Joseph Mallord William Turner, Jackson Pollock and Andrew Ilachinski demonstrates autopoiesis through the combinatorial lens of science, philosophy and art. In particular, the scientific concepts found in chaos and complex adaptive systems theories are shown to be reflected in works from the aforementioned artists as a state of becoming to demonstrate a new link between science, philosophy and at that has emerged in the twentieth century. Scientists and artists have revealed aspects of complex adaptive systems theory in portrayals of nature. The philosophical perspectives offered in this paper bolster the link between the science and the art.

A central them to the complex adaptive systems theory and these works of art is what Martin Heidegger referred to as the revealing of truth and the notion of becoming. In complex adaptive systems theory the truth is called emergence; in art it is called creativity or techne; and in philosophy the bringing forth or the becoming. Truth about nature, and the human relationship to nature, is revealed through the combinatorial process of emergence, techne and bringing forth. In nature, this combinatorial process is referred to as autopoiesis because the transformation is derived from self-creation. This connection between the concept of emergence in chaos theory and becoming in Heideggerian philosophy is identified through the writing of the Nobel laureate chemist Ilya Prigogine who

specifically privileged Heidegger in his discussion. In addition, the works from these three artists are shown to meet Heidegger's standard for art in terms of human confrontation with technology and human cognition. These standards are particularly important to substantiate the artwork of Andrew Ilachinski because of the criticisms that often accompany photographic works of art. Heidegger's standard is used to demonstrate that such criticism do not hold for the pieces discussed.

In addition, Turner's and Pollock's art was criticized for its chaotic and random portrayal of nature. Turner's criticisms were expressed before any underlying scientific basis for chaos theory and complexity were firmly rooted. Pollock's criticisms were generated concurrently with the development of science in chaos and complex adaptive system theories which enabled the use of fractal generated geometries in nature to provide a link between his works of art and the science. Ilachinski's photographic art emerged within the context of complex adaptive systems science and provides latent insights into Turner's and Pollock's art as well. In fact, Ilachinski is especially interesting because he holds the unique attributes of holding scientific expertise in complex adaptive systems theory with a PhD in physics in addition to creating photographic artwork.

The technique or *techne* of the artwork of Turner, Pollock and Ilachinski relate to nature's complexity. This relationship proves significant for this paper because "both *techne* and *phusis* (Nature) are forms of *poiesis*, or 'bringing forth.' *Phusis* is the highest form of *poiesis* because it is the

bringing forth of that which discloses itself from out of itself or, more simply, of what has its power of disclosure within itself" (Costello, 2012, p. 103). The autopoiesis of nature is revealed by an understanding gained through the union of science, philosophy and art.

The complexity in the artwork of Turner, Pollock and Ilachinski illuminates autopoiesis in nature within the context of science, philosophy and art. This paper provides a general overview of complex adaptive systems science as a foundation for the discussion. A discourse on the artistic philosophies pertaining to complex adaptive systems follows the scientific foundation in order to reinforce the underlying human interpretation of nature through science, philosophy and art. The philosophical discussion confirms Turner's, Pollock's and Ilachinski's status as artists. The artistic philosophy resolves why their work qualifies as art based on Heideggerian philosophical principles of the human confrontation with technology and human cognition. The section on autopoiesis illuminates nature's ability to transform itself using specific portraits from each artist. The discussion argues that the union of the complexity sciences, philosophy and art fulfills the promise of art defined as the revealing of truth. This revelation aligns with the scientific concept of emergence and the philosophical notion of becoming. The final section finishes with closing remarks and conclusions.

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The science of complex adaptive systems

Complex adaptive systems theory is a relatively new and developing area of scientific research. The mathematics underlying chaos theory evolved from developments in the nineteenth-century. "Chaos theory can be traced back to Henri Poincare's discovery in 1892 that certain orbits of three or more celestial bodies can exhibit certain unstable and unpredictable behavior. A full proof that Poincare's unstable orbits are chaotic, due to Smale, appeared only 70 years later" (Ilachinski, 1996, p. 21). Poincare's discovery came after the artwork from Turner discussed in this paper.

Ernst Mayr and Ilya Prigogine were two scientists who led the way in transforming the notion of science from one based on a Newtonian perspective of the laws of nature to one of probability and random events. Mayr was an evolutionary biologist and Prigogine a Nobel laureate chemist. The research from both scientists moved away from reductionist theories and toward theories of emergent ones where systematic states are irreversible. Their research on inherently complex systems led them to this path.

In Darrell Arnold's book on systems theory, Debora Hammond discusses the emergence of new approaches to dealing with the complex problems that could not be addressed within a Newtonian framework alone:

> Although its roots can be traced back centuries, and even millennia, systems theory— and the corresponding systems approaches to dealing with complex problem situations— emerged as a distinct field of inquiry in the mid-twentieth century through

a confluence of developments in science and technology. Revolutionary discoveries in the physical sciences in the early twentieth century— quantum mechanics and the theory of relativity— had already exposed the limitations of the Newtonian framework that had dominated scientific inquiry since the seventeenth century. In the biological sciences, the emerging understanding of feedback processes and the open system nature of living systems discoveries in the physical sciences in the early twentieth century— quantum mechanics and the theory of relativity— had already exposed the limitations of the Newtonian framework that had dominated scientific inquiry since the seventeenth century. In the biological sciences, the emerging understanding of feedback processes and the open system nature of living systems pointed to the need for an expanded scientific framework to address the complexity of these systems. (Hammond, 2014, p. 326).

Arnold notes that a principle attribute of these complex systems are the emerging functions of a system that derive from the whole that could not be realized through a structured combination of the physical laws. He points to Ernst Mayr's explanation of why genetic information is relevant in analyzing diseases in some cases and others not. Environmental factors compete with genetic tendencies in ways that are not predictable. (Arnold, 2014, p. 279)

Mayr comments on the contrast between the simplicity and complexity of the biological sciences.

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> Wherever we look, we find simplifying trends as well as trends towards greater complexity. Parasites are, on the whole, notorious for their many physical and physiological simplifications. All theories that postulated the existence in all organisms of an intrinsic trend toward greater complexity have been refuted. There is no justification in considering greater complexity to be an indication of evolutionary progress. (Mayr, 2001, p. 220)

On the other hand, he also comments on what he sees as the two missing pillars on the framework of modern biology. The first, he states, was the concept of genetic programming. "The other missing pillar was the concept of emergence—that in a structured system, new properties emerge at higher levels of integration which could not have been predicted from a knowledge of the lower-level components" (Mayr, 1997, p. 19). In addition, "every system, every integron, loses some of its characteristics when taken apart, and many of the important interactions of components of an organism do not occur at the physiochemical level but at a higher level of integration" (Mayr, 1997, p. 20). This concept of emergent revolution gained popularity with Lloyd Morgan's book on the subject in 1923.

The connection between evolution and emergence in not solely a connection made by biologists such as Ernst Mayr. Ilya Prigogine also makes this connection as a Nobel laureate chemist as noted by Dorothea Olkowski in Arnold's book. "Prigogine and Stengers thus take us from the static view of classical dynamics to an evolutionary view arising

with nonequilibrium thermodynamics, based on time irreversibility" (Olkowski, 2014, p. 312). Some believed this notion of irreversibility was based on a lack of human understanding; however, Prigogine believed "the source of irreversibility was in the dynamics of interactions involved in those processes" (Earley Sr., 2006, p. 277).

Prigogine does not totally abandon the scientific laws of nature, but he does indicate that our understanding of nature is changing:

> Our vision of nature is undergoing a radical change toward the multiple, the temporal, and the complex. For a long time a mechanistic world view dominated Western science. In this view the world appeared as a vast automation. We now understand that we live in a pluralistic world. It is true that there are phenomena that appear to us as deterministic and reversible, such as the notion of frictionless pendulum or the emotion of the earth around the sun. Reversible processes do not know any privileged direction of time. If you bring together two liquids such as water and alcohol, the end to mix in the forward direction of time as we experience it. We never observe the reverse process, the spontaneous separation of the mixture into pure water and pure alcohol. This is therefore an irreversible process. All of chemistry involves such irreversible processes. (Prigogine, 1984, p. xxvii)

Moreover, Prigogine states that our evolutionary understanding of science questioned the previous human ontology of the world. "As randomness, complexity, and

irreversibility enter into physics as objects of positive knowledge, we are moving away from this rather naïve assumption of a direct connection between our description of the world and the world itself. Objectivity in theoretical physics takes on a more subtle meaning" (Prigogine, 1984, p. 54-55). The relationship between human perception and the corresponding interpretation are more complex. For one thing, the human is part of the scientific experimentation process and cannot be removed from it. The scientific experimental methods set out to question nature, but although this process simplifies nature it does "not deprive it of its capacity to refute most of the hypotheses we can imagine" (Prigogine, 1984, p. 43).

Mets and Kuusk state the Prigogine claims that his research has led to a science that can transcend this depravity of our understanding of nature. They summarize Prigogine's work as follows.

> Prigogine claims that he has succeeded in changing science thoroughly: as previously laws of nature descried timeless being, they now describe becoming and temporal world as it is—complex, irreversible, random, evolving vague… He justifies his claim with mathematical formalism that his theory uses (or tries to use): the specific operators, spaces etc. that are supposed to enable us to describe systems and the world as they really are (Mets and Kuusk, 2009, p. 244).

Prigogine's point is an important one for this paper because art, as an alternative in pluralism, offers a way to

characterize nature in a way that scientific experimentation cannot. "Bertalanffy perceived here a deep significance that constitutes the apex of his whole anthropology (as well as Cassirer's): human progress should be viewed from the perspective of a liberation based on the symbolization ability. Language, myth, religion, and arts would be multiple expressions of this emancipation that culminates in science" (Pouvrea, 2014, p. 96).

Several organizations have emerged to conduct interdisciplinary work in the area of complex adaptive systems since Prigogine's ad Mayr's research. One of the current leading organizational institutions in the field of complex adaptive systems, the Santa Fe Research Institute, was formed in 1984. Complex adaptive systems research at the Santa Fe Research Institute is conducted within a multidisciplinary environment; yet scientists remain divided on the validity and value of the theories being developed within the field. The skepticism is not surprising given the fundamental cultural and institutional transformations required to fully transition to this relatively new paradigm for interpreting the world.

Nevertheless, although reductionism is used by scientists to confirm and refine existing theories, complexity leads them to new frontiers and paradigms. "Complexity is what interests scientists in the end, not simplicity. Reductionism is the way to understand it" (Wilson, 1998, p. 59). For this reason, theorists have used complex adaptive systems science to analyze and investigate many different

phenomena in the world not all of which are strictly scientific. The phenomena encompass:

> the predator-prey relationships of natural ecologies, the economic dynamics of world markets, the chaotic dynamics of global weather patterns, the firing patterns of neurons in a human brain, the information flow on the Internet, the apparently goal-directed behavior of an ant colony, and the competing strategies of a nation's political infrastructure (Ilachinski, 1996, p. 9).

Complex adaptive systems theories have caught the attention of biologists, physicists, mathematicians, engineers, economists, sociologists, writers and artists. A closer look at the underlying principles of complex adaptive systems uncovers the reasons for the growing interest.

In its simplest form, complex adaptive systems theory is "an holistic approach to analysis that views whole systems based upon the links and interactions between the component parts and their relationship to each other and the environment within they exist" (Cham and Johnson, 2013, p. 1). The key components of this definition entail a system of parts, the interactions between the parts, the relationship of the system to the parts and the environmental context of the system.

The concept of emergent behavior is at the heart of complex adaptive systems theory and is integral to nature's autopoiesis. Yaneer Bar-Yam, the New England Complex System Institute's (NECSI) director, provides an in depth

understanding of complex adaptive systems in relation to emergent behavior:

> It is impossible to understand complex systems without recognizing that simple atoms must somehow, in large numbers, give rise to complex collective behaviors. How and when this occurs is the simplest and yet the most profound problem that the study of complex systems faces. The problem can be approached first by developing an understanding of the term 'emergence.' For many, the concept of emergent behavior means that the behavior is not captured by the behavior of the parts. This is a serious misunderstanding. It arises because the collective behavior is not readily understood from the behavior of the parts. The collective behavior is, however, contained in the behavior of the parts if they are studied in the context in which they are found (Bar-Yam, 1997, p. 10).

Ilachinski echoes the significance of emergent behavior in complex systems. "Complex systems theory teaches us that 'complex behavior' is usually an emergent self-organized phenomenon built upon the aggregate behavior of very many nonlinearly interacting 'simple' components" (Ilachinski, 1996, p. 15). He also provides a detailed description of the properties of these systems:

> Complex systems consist of – and their overall behavior stems from – a large assemblage of interconnected (and typically nonlinearly) interacting parts; complex systems tend to be organized

hierarchically, with complex behavior arising from the interaction among elements at different levels of hierarchy; the overall behavior of complex systems is self-organized under a decentralized control; overall behavior is emergent; long-term behavior typically consists of nonequilibrium order; and parts consist more of niches that need to be filled rather than of distinct labeled entities that carry an importance all their own. (Ilachinski, 1996 pp. 10-11)

The two crucial concepts of complex adaptive systems, emergent behavior and complexity, are also shared in artistic and philosophical endeavors. Some artists often refer to their creative endeavors as a behavior that is not planned, staged or predetermined. Their art emerges through their artistic technique. Similarly, philosophers, such as Martin Heidegger, discuss the necessity of revealing truth, poiesis or bringing forth in art. "Art is the origin of the artwork and of the artist. Origin is provenance of the essence in which the Being of a being essentially unfolds" (Heidegger, 1977, p. 182). Emergence and complexity are also important concepts for social and cultural transformation.

Gestalt theories derive from complex adaptive human systems that exhibit emergent social and cultural phenomena. Edward Madden's paper on "The Philosophy of Science in Gestalt Theory" outlines W-Gestalts, according to Wertheimer's schema, as the nature of a summation or a "bundle" using musical melodies as an example. K-Gestalts, according to Koehle's schema, refer to systems of functional

independence and distinguish between microscopically and macroscopically organized physical states (Feigl and Brodbeck, 1953, pp. 560-561). W-Gestalts refer to emergent behavior of a cultural or social system as a whole from a macroscopic perspective, and K-Gestalts refer to changes in behavior of the individual interacting parts of a social or cultural system as a result of macroscopic effects. Gestalt theories are integral to understanding the autopoietic power of nature because human culture had to be transformed through science, philosophy and art over the last two hundred years to reveal, receive and understand the truth concerning the autopoietic powers of nature.

A third notable aspect of complex adaptive systems theory is the notion of the edge-of-chaos. "Systems poised at the edge-of-chaos are optimized, in some sense, to evolve, adapt and process information about their environment" (Ilachinski, 1996, p. 69). Complex adaptive systems lie between ordered or linear predicable systems and chaotic or random systems; hence, these systems lie in a region deemed the edge-of-chaos. "Because the transition region represents the region of greatest *complexity* and lies between the regions in which the behavior is either ordered or chaotic, Langton christened the transition region as the *edge-of-chaos*" (Ilachinski, 1996, p. 69). Perturbations die out in the ordered regime. In the complex regime, the system goes through a phase transition where it is poised to adapt and evolve. A system in the chaotic regime witnesses the effects of perturbations propagating rapidly. Complexity increases in the transition region. Complexity decreases in the ordered

and chaotic regimes. An example that helps visualize these concepts is heating water to a boil. As water heats up there is a predictable rise in temperature. Static bubbles begin to form at the bottom of the pot. As the water temperature continues to rise, the system moves from an ordered to a complex system as patterns of static bubbles become visible, with some bubbles rising to the surface in a line. Continued heating of the water raises the temperature to provoke a sudden transition to the chaotic state of boiling water. The bubbles in overheated water do not follow any emergent pattern; they form and dissipate randomly.

As previously mentioned, contemporary theorists use complex adaptive systems theory to understand phenomena ranging from biological to economic systems.

> One of the most far-reaching ideas of this sort is James Lovelock's 'Gaia' hypothesis, which asserts that the entire earth – molten core, biological ecosystems, atmospheric weather patterns and all – is essentially one huge, complex organism, delicately balanced on the *edge-of-chaos* (Ilachinski, 1996, p. 61).

The creation of Turner's, Pollock's and Ilachinski's art reflects elements of the Gaia hypothesis. Scientists, artists and philosophers are part of nature when viewed within this context.

Emergence in complex adaptive systems, the bringing forth in philosophy, creativity in art and Gestalts in cultural contexts work together to transform the human understanding of the power of autopoiesis in nature.

However, science can lag human intuitive understanding of the world: "certain questions cannot be answered within the context of science" (Bar – Yam, 1997, p. 823). In these cases, artists proffer views for scientists to ponder. In his book on chaos theory, James Gleick quotes one of the leading physicists engaged in research on chaos, Mitchell Fegenbaum, regarding the relationship between art and science. "In a way, art is a theory about the way the world looks to human beings. It's abundantly obvious that one doesn't know the world around us in detail. What artists have accomplished is realizing that there's only a small amount of stuff that's important, and then seeing what it was. So they can do some of my research for me" (Gleick, 1987, p. 186).

Greater truths are uncovered when science, philosophy and art work together as a whole rather than independently. "Neither science nor the arts can be complete without combining their separate strengths. Science needs the intuition and metaphorical power of the arts, and the arts need the fresh blood of science" (Wilson, 1998, p. 230). In the case of complex adaptive systems theory the art preceded the science. The artwork of Turner, Pollock and Ilachinski illustrates the transformational power of autopoiesis in nature when viewed within the context of complex adaptive systems science.

Complex adaptive systems and art share many similarities, especially the relationships between the component parts of systems and the metaphors of artistic symbols:

> The *composition* of works of art, where the spatial relationships and alignment of things creates and conveys structures and meanings, is similar to *models* or *compositions* of physical systems, such as the double helix proposed by Crick and Watson (Figure 3(a)). In both art and science, compositions are formed from *elements* represented by *symbols* that have their own meaning. (Cham and Johnson, 2007, p. 4)

An in depth discussion of the underlying philosophy of art in the context of complex adaptive systems will help uncover the communication of the autopoietic aspects of nature in the artwork of Turner, Pollock and Ilachinski. The discussion in the following section specifically includes perspectives from Martin Heidegger because the relationship between "being" and "becoming" in the discussion of complex adaptive systems theory. "Becoming" is a central theme to emergence. In addition, Prigogine maintains Heidegger's work is one of the most influential to be considered in the last century, especially when his discussion on the human confrontation of technology is considered. (Prigogine, 1984, pp. 32-33, 42, 310).

Artistic philosophy related to complex adaptive systems

Philosophy seeks to determine fundamental truths about the human relationship to nature in a complementary way to the approach used by chaos and complex adaptive system scientific theories. Common allegorical themes and symbols communicated across societies and throughout

history lend credibility to these fundamental philosophies in a similar way that scientific and mathematical symbols do. Observations of the world captured by artists present greater horizons than a single individual or groups of people can imagine.

> The communal mind of literate societies—world culture—is an immensely larger loom. Through science it has gained the power to map external reality far beyond the reach of a single mind, and through the arts the means to construct narratives, images, and rhythms immeasurably more diverse than the products of any solitary genius. The loom is the same for both enterprises, for science and for the arts, and there is a general explanation of its origin and nature and thence of the human condition, proceeding from the deep history of genetic evolution to modern culture. (Wilson, 1998, p. 13)

Prigogine also highlighted the intertwined relationship between culture and the logic of science. "It is important to point out that the new scientific development we have described, the incorporation of irreversibility into physics, is not to be seen as some kind of 'revelation,' the possession of which would set its possessor apart from the cultural world he lives in. On the contrary, this development clearly reflects both the internal logic of science and the cultural and social context of our time" (Prigogine, 1984, p. 309). The internal are derived from scientific rationality and the external from cultural context. Even when revelation is not intrinsic to new

scientific theories there is still a concurrent reflection or imaging that can be found in culture.

Complex adaptive systems theory manifests itself in works of art as portraits, descriptive systems, commentaries and through technical applications of the theories. Portraits present natural complex phenomena that transcend scientific explanations because they invoke visual associations and emotional responses. Descriptive systems permit artists to explore levels of abstraction, invent, innovate and categorize complex phenomena outside the dimensions and boundaries of scientific descriptions. Commentaries allow artists to become part of the complex adaptive systems themselves by incorporating social and cultural perspectives not provided by science. Technical applications provide a rich new toolbox for artists to use in their artistic techniques, e.g., computer generated fractal images, reaction-diffusion systems and cellular automata (Samuel Dorsky Museum of Art, 2002, p. 3).

Computer images generated from fractal geometries exemplify how technical toolboxes developed from complex adaptive systems theories have been used for artistic purposes. "Often the scientists drawn to fractal geometry felt emotional parallels between their new mathematical aesthetic and changes in the arts in the second half of the century. They felt they were drawing some inner enthusiasm from the culture at large" (Gleick, 1987, p. 116). Fractal theory is briefly mentioned here because of the relationship to complex adaptive systems theory and the use of fractal generated images to demonstrate nature's reflection in

Pollock's paintings later in this paper. Fractals are mentioned here because later in the paper they will be used to illuminate the connection between chaos theory, nature and Pollock's art.

This paper focuses on artistic portraits, and more specifically presentations of natural complex phenomena. The focus on natural phenomena serves well to illustrate the autopoietic transformational power of nature. The artwork of Turner, Pollock and Ilachinski, when studied in the context of complex adaptive systems science, demonstrates an example where the artistic observation and communication preceded the development of the scientific theory.

The artists use the concepts of complexity and emergence to uncover autopoiesis in nature. Their work reveals a basic truth about how humans perceive the unfolding world:

> *Universals or near-universals emerged in the evolution of culture*. Because of difference in strength among the underlying epigenetic rules, certain thoughts and behavior are more effective than others in the emotional responses they cause and the frequency with which they intrude on reverie and creative thought. They bias cultural evolution toward the invention of archetypes, the widely recurring abstractions and core narratives that are dominant themes in the arts. (Wilson, 1998, p. 237)

A view of the world as a complex adaptive system may be relatively new for scientists, but has been an abstraction and core narrative for artists for nearly two centuries. Autopoietic

phenomenon caught the attention of artists who sought to capture it in their artwork when the science did not exist to explain the natural phenomenon. Ilachinski's photography provides the linchpin to this argument because as a physicist and photographic artist he has established a direct connection between science, philosophy and art. Ilachinski's connection retroactively illuminates autopoiesis in Turner's and Pollock's portraits as well.

Critics often argue that portraits of nature cannot be works of art because they are mere snapshots of a scene. Turner, Pollock and Ilachinski demonstrate that portraits of nature can engender an artistic quality in a Heideggerian sense. Portraits of nature communicate spirituality, but moreover, truth is revealed as humans cognitively engage technology in the process of bringing forth works of art.

Art captures and communicates knowledge in a way that cannot be accomplished by other means; it is a means of knowledge elicitation. Art captures information hermeneutically. It creates a dialog to elicit information in other ways. Art enables humans to see their social situation from different perspectives. It fosters a social dynamic to reveal information that may be hidden or withheld (Cham and Johnson, 207, p. 2). Artistic venues enable the communication of information to humans for further interaction within a social system. However, art demands more than communication. Cham and Johnson continue their discussion of art and identify the value in the discovery of basic truths:

> Contributions art can make to the science of complex systems encompass: data collection, inspiration, communication, discovery of immutable truths through hermeneutics, experiments generating artworks to explore the interaction between complex adaptive systems science and art (Cham and Johnson, 2007, p. 13).

The idea that art enables discovery of certain immutable truths is an important concept for comprehending autopoiesi*s* in works of art.

For Martin Heidegger, this fundamental requirement for art to reveal immutable truths is of the utmost importance for great works of art. He described the process of revealing and concealing truth in contrast to Cham's and Johnson's emphasis on discovery. Truth exists and humans uncover it. In the process of uncovering truth humans also experience the process of concealing other truths. Humans become receptive to some truths, but reject others.

> Art lets truth originate. Art, founding and preserving, is the spring that leaps to truth of beings in the work. To originate something by a leap, to bring something into being from out of its essential source in a founding leap—this is what the word 'origin' [Ursprung literally, primal leap] means. (Heidegger, 1977, p. 202)

The processes of revealing, bringing forth, becoming, creation and autopoiesis are essential for the truth Heidegger discussed and strongly correlates with the concept of emergence in chaos theory. Truth must be understood within

the process by which the artist engages in the revealing. "Art is the origin of the artwork and of the artist. Origin is provenance of the essence in which the Being of a being essentially unfolds" (Heidegger, 1977, p. 182). Heidegger sees both the artist and the nature of the artwork working together in the unfolding of truth. The artist is part of the autopoietic power of nature in the context of Gaia hypothesis. In addition, "the work's createdness, however, can obviously be grasped only in terms of the process of creation" (Heidegger, 1977, p. 183). The process the artist uses to bring forth the art, as well as the context of the process, are important as well. Heidegger's description of works of art is similar to the relationships of the whole and the parts described in complex adaptive systems theory.

Heidegger distinguishes the aesthetic aspect of art from the cognitive aspect of art. He was extremely reserved in his interpretation and consideration of works he considered to be true art. "It is also that such theories collapse the distinction between the artistic and aesthetic spheres, ignore aesthetic pleasure in favor of cognitive values that may be found only in certain forms of art" (Gilmore, 2002, p. 525). For Heidegger, there must be a cognitive confrontation of the human and technology for art to exist. Part of the reason for this confrontation is that the human is also engaged in a process of receiving, as well as the process of unfolding. The human must decide what and how to receive what is being unfolded, i.e., becoming. The receiving takes place within the artist, but also within others who view the art. "Where this bringing forth brought forth

expressly brings the openness of beings, or truth, that which is a bringing, it is rather a receiving and removing within the relation to unconcealment" (Heidegger, 1977, p. 187). There is cognition in the revealing and the receiving of art.

The necessity for an explicit confrontation between the human and technology in the context of art is especially pertinent to the discussion of photographic artwork. Many critics maintain that photography cannot assume the status of artwork because the use of a camera, especially an automated digital camera, relegates the image to a mere snapshot of the world. Costello examines this specific question, not only in the realm of Heidegger's philosophy of art, but also in terms of Walton's. Costello summarizes that "these two responses are mutually implicating: photographic art resists technology to the extent that it is mind-dependent" (Costello, 2012, p. 112). Photography becomes art when the artist is cognitively engaged in the process of creation; art must unfold from a mind-dependent process. This point is especially important for Ilachinski's art. The artist must confront technology in the unfolding of truth. Turner, Pollock and Ilachinski fulfill Heidegger's prerequisites for art.

The next section illuminates the autopoietic transformational power of nature revealed in specific portraits created by Turner, Pollock and Ilachinski. All three artists have created representative portraits of nature. Each uses the hermeneutics of their medium to capture and communicate a basic truth about nature, i.e., autopoiesis. Lastly, the three artists are shown, in the Heideggerian sense, to be engaged in the unfolding of the fundamental truth of

autopoiesis in nature. Autopoiesis runs parallel through the underlying science, philosophy and their art.

Autopoiesis in the art of Turner, Pollock and Ilachinski

The artwork of Turner, Pollock and Ilachinski demonstrates autopoiesis in nature when viewed in the context of science, philosophy and art. The principles of complexity and philosophy discussed in the previous sections are illuminated in specific works from each of these three artists. The basic truth is revealed by illustrating the concepts of emergence, complexity, a focus on nature, and a hermeneutic use of artistic technique. The artist's confrontation with technology in a cognitive, mind-dependent manner reveals the fundamental truth about the autopoietic transformational power of nature. Each artist fulfills the Heideggerian qualification for art.

Three works demonstrate Joseph Mallord Turner's portrayal of nature's autopoietic properties. Although the Turner was not aware of the science that now supports this argument, his artwork demonstrates nature on the edge-of-chaos. The edge-of-chaos is evident in several of his paintings where images and objects can be seen at a glance in the middle of a maelstrom without the detailed depictions that would enable the object to be recreated. One such painting is referred to by Gombrich as *Steamer in a Snowstorm* (Gombrich, 1995, p. 493). Although Gombrich refers to this painting by the aforementioned title. The William Turner Gallery accessible on line shows the painting under the title of *Snow Storm – Steam-Boat off a Harbour's*

Mouth and simply *Snowstorm* (William Turner Gallery, 2016). Each source depicts the year of the painting as 1842. In any event, the painting is significant for the way Turner captures the human perception of the boat in the storm. "Nobody could reconstruct a nineteenth-century steamer from Turner's seascape. All he gives us is the impression of the dark hull, of the flag flying bravely from the mast—of a battle with the raging seas and threatening squalls" (Gombrich, 1995, p. 493). Turner's art reflects the shift from painting traditional Catholic religious figures to an embodiment of the spiritual power in nature. His artwork "gives us a conception of the grandeur of nature at its most romantic and sublime" (Gombrich, 1995, p. 493). Turner repeats this theme in a *Stormy Sea with a Blazing Wreck* (Dixon, 2008, p. 24). Again, he presents us with the image of a near indiscernible ship at sea. Although the human is not specifically depicted in these artworks, the sense of the human on the ship in the maelstrom is brought forth. Nature's unfolding event dwarfs the human. Turner was criticized for trying to portray nature in the *Snowstorm, Avalanche and Inundation*. Critics argued artists could not capture the chaos of an avalanche in the Alps, although "the belief that the Alps were an expression of chaotic nature and therefore not worthy of depiction began to change around 1800" (Westheider, 2011, pp. 66-67). This change indicates that humans were beginning to recognize that chaos was perhaps a topic that humans could better comprehend even though Poincare's theories would not emerge until the end of

the century. These examples of Turner's artwork reveal the autopoietic force of weather in nature.

Jackson Pollock's artwork also makes the connection to autopoiesis in nature, but through an abstract manner. Pollock does not explicitly portray images of nature that we can decipher at first glance. However, armed with knowledge of the complexity sciences, and the fractal theories previously discussed, the comparison is clearly evident. Casti and Karlqvist present a series of comparisons of Pollock's artwork to images created from fractal algorithms and photographs of nature. Emergent images of seaweed are compared to a section of Pollock's painting entitled *Full Fathom Five* which he created in 1947. Pollock's *Number 32*, painted in 1950, is compared to biological images of tree roots. Most striking was Pollock's painting *Number 31* which he painted in 1950 and is compared to emergent images of the forest and snow captured through photography by R. P. Taylor (Casti and Karlqvist, 2003, pp. 164-166). When Pollock's artwork is viewed in the context of contemporary complex adaptive systems theory the similarities bring forth a new description, greater understanding and more refined truth that lies at the foundation of his portraits:

> Clearly, the identification of Pollock's patterns as fractal is a vital step for understanding their artistic significance, both in terms of 'form' and 'content.' Rather than using the traditional terminology of Abstract Expressionism, his works are now being re-interpreted as a direct expression of Nature, and the

discovery has since been labeled as 'Fractal Expressionism.' (Casti and Karlqvist, 2003, pp. 119) Turner's art expressed the concept of the edge-of-chaos and Pollock's the fundamental emergent patterns brought forth by nature. Both Turner and Pollock revealed these truths coincidently using an intuitive level of understanding that was yet to be defined with a refined scientific explanation. The final artist discussed in this section had the benefit of creating his artwork after complex adaptive systems theories were developed. He himself is one of the theorists.

Andrew Ilachinski has been a photographer since his childhood and a physicist in adulthood. His expertise in complex adaptive systems is evident in his publications while at the Center for Naval Analyses. His passion, however, lies in his photography. He has integrated his knowledge as a scientist and creative abilities as an artist in a cognitive manner and fulfills Heidegger's prerequisites for art:

Because of my training as a physicist, my approach to photography has always been somewhat cerebral. Of course, my mind is certainly clear of equations while I shoot, and my "trigger finger" is driven more by intuition than by math; but, I just as often find myself analyzing the Whys and Meanings of a shot, with something approaching a clinical precision even as the shutter is clicking. I support it is the price I pay for having a decidedly left-brain "day job." So naturally, my cerebral side is almost always the one that guides me from shot to shot, and decides what

> new projects to start. Almost, but – not happily – always. (Ilachinski, 2007, p. 129)

In the chapter on water flow in *Landscapes of the Soul; Reflected Shadows of Self* he captures the motion of water in the Potomac under unique lighting conditions to reveal the emergent patterns that nature unfolds (Ilachinski, 2007, pp. 9-47). The similarities between these images and Turner's depiction of the seas are evident throughout Ilachinski's artistic photographs. "So it is to water – or more precisely, to the *flow of water*, as an embodiment of energy and life – that we turn to as our first landscape of the soul" (Ilachinski, 2007, p. 11). Throughout this chapter, Ilachinski depicts water as the whole, i.e., the integration of all the droplets into a wave or flow of water. This observation leads to a unique attribute of Ilachinski's art in the context of complex adaptive systems which is not uncovered in the artwork of Turner and Pollock. Turner and Pollock portray the emergence of nature as the whole, similar to a W-gestalts. The W-gestalt is also evident in Ilachinski's photographs of water flow, but so are the changes to the parts as expressed in K-gestalts.

Unlike Turner and Pollock, Ilachinski also reveals the transformation to the pieces of the whole as in K-gestalts. In his chapter on micro worlds he explores this theme (Ilachinski, 2007, pp. 128-165). He talks about "the creative fire that instantly stirred within my photographic eye upon seeing the limitless compositional possibilities of the 'world within worlds' of trapped air bubbles alone suffices to ignite the candles that evening may be a slight exaggeration"

(Ilachinski, 2007, pp. 129). Ilachinski's photography captures complex adaptive systems unfolding in nature. He photographs autopoietic moments when the whole of nature is transformed by its parts, as well as moments when the parts of nature are transformed by its whole.

The artwork of Turner, Pollock and Ilachinski demonstrate the autopoietic transformational power of nature. Turner's movement to spiritual expressions of nature, Pollock's abstract patterns, and Ilachinski's micro/macro views of nature reveal the truth that nature is self-transforming or becoming before us. Turner incorporated this sense into their art before complex adaptive systems theories were developed. Pollock's art reflected the fractal images in nature as the mathematical basis for fractal theory was developing Ilachinski used his knowledge of complex adaptive systems theory to embody and capture the fundamental autopoietic truths of nature in his photographic works of art. The examples of complexity in nature in Ilachinski's art retroactively bring forth a new context to view the art created by Turner and Pollock.

Conclusion

Science, philosophy and art have engaged humans in many ways throughout history. A new union between science, philosophy and art has emerged in the twentieth century. Artists have revealed aspects of complex adaptive theory in portrayals of the autopoietic powers of nature. Although artists captured nature's complexity for nearly two centuries, human understanding was limited because the

artistic and philosophical expressions of complex adaptive systems preceded its scientific development. Science had to catch up to artistic intuition.

The technique, or techne, of the artwork of Turner, Pollock and Ilachinski are part of nature's complexity. Each artist's techne is different. Turner paints chaotic landscapes. Pollock uses expressionism in his paintings. Ilachinski captures nature's unfolding transformations through photography. Their depiction of nature proves significant for this paper because although both techne and phusis (Nature) are forms of poiesis, phusis is the highest form of poiesis. Nature has the power to disclose and transform itself. The autopoietic aspect of nature is revealed within the context of art, philosophy and science. The concepts of emergence, complexity and the edge-of-chaos in complex adaptive systems theory provide the foundational understanding to recognize autopoiesis in the artistic portrayals of each of the three artists.

The artwork of Turner, Pollock and Ilachinski illuminates the autopoietic powers of nature through portrayals of chaotic scenes of weather, fractal-like images found in nature and micro/macro views of water flow. The works from these three people qualify as art from aesthetic perspectives, but moreover from Heidegger's cognitive philosophy of art. First, their works of art communicate basic immutable truths across cultures and across time. Second, each artist had a cognitive, mind-dependent confrontation with technology while creating their artistic works. Heidegger placed a high value on the cognitive aspects of

art. Each artist has an aesthetic appeal, but their use of a cognitive, mind-dependent artistic process enables them to confront technology rather than to surrender to it. Finally, each artist reveals a truth about the autopoietic power of nature through portrayals of weather, fractal patterns and water flow.

Autopoietic images are present in the works of art by Turner, Pollock and Ilachinski. Turner illustrates nature on the edge-of-chaos through portrayals of storms at sea an on land. Pollock used expressionism to create abstract images that reflect fractal-like patterns in nature. These patterns repeat to form natural landscapes. Ilachinski's art illuminates nature autopoietic powers that transform the whole of nature from its parts, as well as transform the parts of nature from its whole using images of water flow and bubbles. Each artist reveals a truth in the Heideggerian sense, and in so doing, also conceals a corresponding truth about autopoiesis. For example, Turner reveals nature on the edge-of-chaos, but conceals fractal-like patterns, as well as the relationship between the micro/macro interactions of the parts.

This paper argues that the complexity seen in the art of Joseph Mallord William Turner, Jackson Pollock and Andrew Ilachinski demonstrates autopoiesis through the combinatorial lens of art, philosophy and science. This thesis was bolstered by providing a foundational understanding of complex adaptive systems theory, discussing the underlying philosophical context for the art, qualifying the works of art from each artist in the Heideggerian sense and illuminating autopoiesis in their artwork using specific portrayals and

representations of nature. Autopoiesis is a transformational force of nature.

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The Gift of the Sublime: A Contemplative Reading of Mary Shelley's *Frankenstein*

Mary Keator
Westfield State University

Abstract

Since its inception, Mary Shelley's, *Frankenstein*, has captivated readers and artists, inspiring films, a Broadway musical, television shows, paintings, stories, poems, songs, books, articles and even postage stamps. Scholars, too, continue to be captivated by this story and have examined it from numerous perspectives, including, but not limited to, the literary, theological, philosophical, psychological, ethical, feminist, technological, and environmental viewpoints. This study engages in a contemplative reading of *Frankenstein* and investigates Shelley's reflections on the dire consequences of a severed, unholy relationship betwee n the sublime, the self and technology.

Since its inception, Mary Shelley's, *Frankenstein*, has been captivating both readers and researchers, inspiring films, a Broadway musical, T.V. shows, paintings, stories, poems, songs, books, articles and even postage stamps (1997 and 2002). It seems as though we just cannot get enough of Frankenstein and his nameless creation (the monster, creature, devil, fiend, and dæmon). Scholars, too, continue to be captivated by this story, examining it from numerous perspectives, including, but not limited to, the literary, theological, philosophical, psychological, ethical, feminist, technological, and environmental viewpoints. One would think that the research on *Frankenstein* has been utterly exhausted; yet, I enter into this conversation to offer an unexpected insight I received through a contemplative reading of the text.

Concerned with the diminishing effects that science was having on the human spirit and the natural world, the Romantics of the 18th and 19th century explored in their works the topics of, "nature, compassion of mankind, human feelings, freedom of the individual and rebellion against society."[1] Aware that the enlightenment thinkers had objectified nature, examining and categorizing it, the Romantics chose to commune with nature, contemplating its power. Rather, than spending time dissecting it, they chose to be *with* it, engaging themselves in a contemplative relationship with the natural world. Situated within this genre, Shelley writes *Frankenstein*, opening a dialogue about the relationship between the self, the natural world and the technological.

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Within Shelley's story, the dialogue continues amid two approaches to technology: the mechanistic and the artistic. *Techné*, as mechanistic, employs what Heidegger later termed, "calculative thinking,"[2] focusing on *how* and *can*. The danger of calculative thinking is that it may rush humanity towards destruction as it isolates the human person and drives them into a life of purposeless activity.[3] On the other hand, *techné*, as the artistic, creates from an integral holistic perspective *with* life. By employing, "meditative thinking,"[4] it gently guides human beings into deeper contemplation on *why* and *for what deeper purpose*. It calls upon the sublime and its inherent beauty, goodness and truth. As Bartlett cautions, "there is no humanity without something sacred, something beautiful, something valuable, something erotic. Knowledge of the cosmological object alone, without these is no knowledge worth having."[5] Contemplation uncovers what is sacred, beautiful, valuable and erotic in life. Although scientists can come to understand *how* things work and can manufacture things to their will, this information does not necessarily create better health and wholeness in human beings and the world in which they live. A technological world is a hurried world, a manufactured world, and a sterile world. Technology is not sacred in and of itself, and it can never humanize. Therefore, if human beings want to live in right relationship with technology they need to contemplate the sublime.

Perhaps a good way to demonstrate the contrast between *techné*, as artistic, and *techné*, as mechanistic, is to contrast the way Mary Shelley uses *techné* to create her story

with the way Victor uses *techné* to create his creature. Shelley's power lay in her ability to remain open and available as she plunges herself into her deepest questions about human beings, the natural world and the rising technological inventions of her time. In subjective reflection and intersubjective dialogue, she questions the rising issues of the day such as the principle of life, the experiments of Darwin, and the possibility of re-animating a corpse.[6] As she contemplates these difficult issues, her imagination reveals a ghost story. "When I placed my head on my pillow I did not sleep, nor could I be said to think. My imagination, unbidden, possessed and guided me, gifting me the successive images that arose in my mind with the vividness far beyond the usual bounds of reverie."[7] Mary Shelley explains in this passage how the story of *Frankenstein* reveals itself to her.[8] As the story reveals itself, she remains, "open to the mystery,"[9] and beholds the horrific images.

> How can I describe my emotions at this catastrophe, or how delineate the wretch whom with such infinite pains and care I had endeavored to form? His limbs were in proportion, and I had selected his features as beautiful. Beautiful! Great God! His yellow skin scarcely covered the work of muscles and arteries beneath; his hair was of a lustrous black, and flowing; his teeth of a pearly whiteness; but these luxuriances only formed a more horrid contrast with his watery eyes, that seemed almost of the same colour as the dun white sockets in which they were set, his shriveled complexion, and straight black lips.[10]

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Shelley not only accesses these powerful images and feelings, she embraces them. "I opened my mind in terror," states Shelley. She continues: "The idea so possessed my mind, that a thrill of fear ran through me, and I wished to exchange the ghastly image of my fancy for the realities around."[11] Although terrified, Shelley stays with the vision and uses it to create her ghost story. Her process is deeply organic. Using the *techné* of rhetoric, she creates a beautiful wisdom tale still read and revered nearly two hundred years later. Conversely, Victor works hurriedly.

> As the minuteness of the parts formed a great hindrance to my speed, I resolved, contrary to my first intention, to make the being of a gigantic stature; that is to say, about eight feet in height, and proportionably large. After having formed this determination, and having spent some months in successfully collecting and arranging my materials, I began. No one can conceive the variety of feelings which bore me onwards, like a hurricane, in the first enthusiasm of success.[12]

Victor's actions harken back to the Enlightenment period where everything was reduced to a calculable measurement. He challenges life, manipulating it to his liking. His creature has to be, "gigantic…eight feet in height." Victor works frantically, fueled by ego. Unlike Shelley, he is not open to the mystery and what results is a technological nightmare.

However, embedded within both the artistic and mechanistic views of technology dwells a deeper power, the sublime. Seven times Shelley uses the word sublime,

highlighting aspects of its nature. It is the sublime, which animates Victor and his creature. All along Shelley was open to listen to it, receive from it and create with it, but not Victor. Victor's own ego blocked him from receiving its fullness. While her story is tragic, demonstrating what happens when human beings steal from the sublime for their own selfish reasons, tragedy does not have to be the final word. *Frankenstein* offers readers an opportunity to reflect on the dire consequences of a severed, unholy relationship between the sublime, the self and technology and use these insights to restore right relationship.

In *Frankenstein*, Shelly's revisits an age-old discussion on *techné* that dates back to the Greek Prometheus myth. Like Prometheus, Victor Frankenstein steals fire, but unlike Prometheus, Victor steals it for his own benefit – at least Prometheus stole the fire to share with humans. Moreover, Victor failed to contemplate fire and work *with* it for the benefit of humanity. As Maritain notes,

> It takes a long time and a great deal of concentration to become deeply acquainted with any material object. The mystical knowledge of matter has long been practiced but seldom recognized. Abstract knowledge is easy to acquire and to identify as such, but concrete knowledge is a different thing. Concrete knowledge uses quite different channels. It is absorbed by means of the sense organs and muscles. It comes through exteroceptors, such as the eye and the ear, and also through proprioceptors in the muscles.[13]

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Caught up in his ego and scientific calculations, Victor creates without using the wisdom of his senses, without contemplation and without dialogue with others, noting, "study before had secluded me from the intercourse of my fellow-creatures, and rendered me unsocial."[14] In *Frankenstein*, Shelley cautions her readers of any knowledge that comes too quickly, without engaging in contemplation, intersubjective dialogue and human sensibilities. She warns of the harm that comes about when we objectify the source of life because by doing so, we objectify life, seeing it solely as a commodity to fulfill our fleeting desires. Objectifying life depletes energy, both in the natural world and ourselves. This is why Victor is not healthy; this is why he feels drained: "my cheeks had grown pale with study and my person had become emaciated with confinement."[15] Furthermore, Victor's work not only diminishes him, but the life of everyone else around him. On the other hand, whenever we allow the sublime to remain subject, we feel nourished and rejuvenated. Like many of the Romantic writers during the 18th and 19th centuries, Mary Shelley contemplates the sublime. [16] Therefore, before progressing any further into the story, I would like to offer a brief historical overview of the sublime.

For the ancient Greeks, the sublime was both excellent and horrific. The Greek word for sublime – *megaleíos* - referred to that which is the grand, lofty, awe-inspiring, supreme, excellent, and complete. In Longinus's treatise, "On the Sublime (*Peri Hupsous*)," he described the experience of the sublime as "one which sweeps readers or viewers along, robs them of rational control over their feelings, and opens

hitherto unknown vistas of the infinite, the horrendous, or the incomprehensible."[17] According to Des Pres, "its chief effect on the reader was spiritual transport-a sense of being uplifted, of being carried beyond oneself as if one shared in or had indeed become sublime."[18] To be lifted up and spiritually transported is also ascribed to *ekstasis* (astonishment). For the ancient Greeks, *megaleíos* and *ekstasis* were related to the journey (*theōria*) undertaken by the philosophers as they sought to experience astonishment and sublimity. Through *theōria,* the philosophers were drawn outside of their own limited worldview into more profound experiences of Beauty, Goodness and Truth. This journey, as described by Plato, was transformative. The philosopher "moves out of the darkness of the cave and into the light where he sees with the 'eye of his soul.'"[19] Once the philosopher sees with 'the eye of his soul,' he began to change; he enters the depths of the unknown in search of something new, yet to be experienced.

In Book X of *The Nicomachean Ethics*, Aristotle refers to *theōria* "as being both the highest [and most continuous] form of activity...since the intellect [or *nous*] is the highest thing in us, and the objects that it apprehends are the highest things that can be known."[20] For Aristotle, this experience came about not by the active life (*vita activa*), but by way of the contemplative life (*vita contemplativa*), which he considered the ideal life in the society. Through the practice of *theōria,* the philosopher remained in a continuous state of wonder, allowing himself to be drawn outside of himself into a subjective ecstatic experience (*ekstasis*), where he became one with the object of his contemplation. Mark Shiffman,

associate professor of classical studies at Villanova University, writes,

> Starting with Socrates, ancient philosophers in the Platonic-Aristotelian tradition contend that the human being is best understood as the subject of wonder. Awakened by wonder, rational inquiry opens us to truth not ultimately grounded in power, but in the Good. The subject of wonder is not simply a meeting point of accumulated powers gathered at a center of control. On the contrary, he is a subject that is always also oriented towards a center outside itself. The wondering being is an 'ecstatic' subject, from the Greek, *ekstasis*, standing outside oneself… For Plato, we are preeminently erotic beings, in love with the attractive beauty of goods and truths not of our own making. We are penetrated and called forth by the intimate effects of beauty and truth, drawn outside ourselves into the world and into contemplation.[21]

In other words, human beings by nature are born to be "subjects" of wonder. As subjects and practitioners of contemplation, i.e., *theōria*, human beings are awakened to Beauty, Goodness and Truth. Wonder is not goal-oriented; rather it is a subjective experience.

The ancient Greeks called this type of freedom to wonder, leisure (*schole*). Aristotle stated, "We are *not-at-leisure* in order to *be-at-leisure*."[22] Leisure is a subjective inner experience, a wondering, a beholding. As Pieper points out, "Simple looking at something, gazing at it, 'taking it in,' is merely to open our eyes to receive the things that present

themselves to us without any need for an 'effort' on our part to 'possess' them."[23] One who was still, open and receptive was able to engage in what Heraclitus called "*Listening-in to the beings of things*."[24] Thus, as the philosopher engaged in a life of leisure, he opened himself to wonder, to contemplate, to behold, and to the *listening-in to the beings of things*. This inward journey guided him beyond his limited worldview into a deeper subjective knowing and experience of wisdom, or *ekstasis.*

Interestingly enough, the Greek word for leisure, *schole*, is where we get the word school.[25] Herbert shares, "To the classical mind, leisure is closely associated with the ultimate and perfect good of man, and therefore with human freedom and the *artes liberales*, while work is tied to the realm of necessary, contingent, and subordinate goods, and hence to the *artes serviles*."[26] To be educated (schooled), therefore, is to engage in a life of leisure (to be free to wonder), to participate in the *artes liberales* (liberal arts), and to be afforded the opportunity to experience wisdom. Today, this type of study is also known as the humanities.

When Longinus wrote his work, "*Peri Hupsous* (*On the Sublime*)*,*" he wrote from within this understanding of *ekstasis, theōria, and schole* and then framed it in rhetorically. As noted by Macksey, "He [Longinus] is concerned…with certain distinctions of conceptions and expressions, with sources and effects achieving a state of elevation that he calls *ekstasis* (transport, in the quite literal sense: a state of being 'carried outside' oneself)."[27] Longinus sought to arrange words and expressions to lift up the reader, "lift him near to

the great spirit of the Deity,"[28] transporting him to a new understanding and appreciation.

In the 18th century, Edmund Burke revisited the sublime, describing it as a power capable of producing astonishment, an astonishment tinged with a degree of horror. However, as noted by Bates in, *From Classic to Romantic: Premises of Taste in Eighteenth Century England*, Burke creates a "separation of the beautiful and the sublime."[29] Aidan Day also remarks on this separation stating, "A profoundly gendered economy controls Burke's definition of the sublime and the beautiful, where the major term sublime is masculinized and the lesser term, the beautiful, is feminized."[30] The point here is that the understanding of the sublime began to shift from its proper place with *ekstasis*, *theōria* and *schole* observed by the ancient Greeks to a contemporary focus on terror and horror produced by an experience in nature.

> The passion caused by the great and sublime in nature, when those causes operate most powerfully, is Astonishment; and astonishment is that state of the soul, in which all its motions are suspended, with some degree of horror. In this case the mind is so entirely filled with its object, that it cannot entertain any other, nor by consequence reason on that object which employs it. Hence arises the great power of the sublime, that far from being produced by them, it anticipates our reasonings, and hurries us on by an irresistible force.[31]

For Burke, the sublime captures the mind, suspending the thoughts of the experiencer, "with some degree of horror. He continues, "if the pain is not carried to violence… [it is] capable of producing delight; not pleasure, but a sort of delightful horror, a sort of tranquility tinged with terror."[32]

As Burke acknowledges, horror does not have to be the final experience of the sublime, but it can be if the experiencer is "carried to violence." In, "The Physiological Sublime: Burke's Critique of Reason," Vanessa Ryan comments that, according to Burke,

> The sublime experience is seen as leading, on the one hand, to an overpowering of the self and, on the other hand, to an intense self-presence and exaltation, sometimes even to self-transcendence. The central question is thus not to what extent the sublime is located in the subject, but in what way the experience of the sublime affects the perceiving subject: Does the sublime enlarge us, or diminish us? Does the sublime annihilate our sense of self, or does it affirm and heighten our sense of identity?[33]

The question raised by Ryan offers an important insight for reading *Frankenstein* as well as a lens to reflect on our relationship to developing humanity in a world of ever increasing, ever advancing technology. The pertinent question here is: does Victor Frankenstein's experience with the sublime enlarge or diminish, affirm or annihilate him; furthermore, does our experience with the sublime enlarge or diminish us, affirm or annihilate us?

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In the 19th century, Kant distinguished between what he termed the mathematically sublime and the dynamically sublime. Of the first, he writes the "Sublime is the name given to what is absolutely great" and of the second, "If we are to estimate nature as dynamically sublime, it must be represented as a source of fear."[34] In one breath, Kant discusses the sublime as "absolutely great" and, on the other hand, as a "source of fear." According to Kant, even though the sublime has the potential to "elevate our soul above its usual level,"[35] it can only do so if there is no danger of us being dominated by its power.

What the ancient Greeks, Burke and Kant agree on is the inherent power of the sublime to elevate and transport the experiencer into an ecstatic transformative experience. Burke and Kant note that this experience can bring about an awakening, even if at first terrifying, that is if one can break through self-absorption.[36] As Charles Taylor notes, "The sight of 'Excess', vast, strange, unencompassable, provoking fear, even horror, breaks through this self-absorption, and awakens are sense of what is really important…"[37] However, if fear overwhelms the experiencer, the gift is never able to be experienced. Mary Shelley revisits the nature of the sublime as both horror and beauty. In keeping with the 18th century discussion of aesthetics, Shelley is concerned with the artistic, specifically "how a particular experience of being moved impacts the self."[38] All who encounter *Frankenstein* are left with a choice: either repeat Victor Frankenstein's mistake and look away from horror and danger, or learn from his mistake and behold horror and danger. By beholding horror and

danger, readers have the opportunity to encounter the sublime within the horror and danger and become inspired to develop a holy-intimate relationship with the sublime, the self and the technological as they work *with* nature to create technologies that reflect this holy-intimate relationship. Shelley obscures in her writing the deeper truth that the sublime is always more powerful than the horror and danger revealed in a limited technology. The horrific and monstrous can never cancel out the deeper Beauty, Goodness and Truth that is always inherent within the sublime and waiting to be experienced.

As previously mentioned, the word sublime appears seven times in *Frankenstein,* each time revealing a deeper understanding of its nature and purpose.[39] The first appearance takes place after the death of Victor's brother and adopted sister. His father, Alphonse Frankenstein, seeking solace for Victor's distress (a bit disconcerting given that all of the emphasis is on Victor and his distress, even though his father has just lost his son and adopted daughter) takes his family on an excursion to the valley of Chamounix. Victor recounts,

> It was from this cause that he had removed to the country; and, induced by the same motive, he now proposed that we should all make an excursion to the valley of Chamounix. I had been there before, but Elizabeth and Ernest never had; and both had often expressed an earnest desire to see the scenery of this place, which had been described to them as so wonderful and sublime. Accordingly we departed from Geneva on this tour about the middle of the

month of August, nearly two months after the death of Justine.[40]

Here, Victor uses the word, sublime, in conjunction with the word, wonderful, to describe a particular place in nature. The place is wonderful and sublime, but we do not yet know what makes it sublime. As Victor continues, we discover that the sublime refers to the way in which the natural elements come together to create an experience.

> The next day we pursued our journey upon mules; and as we ascended still higher, the valley assumed a more magnificent and astonishing character. Ruined castles hanging on the precipices of piny mountains; the impetuous Arve, and cottages every here and there peeping forth from among the trees, formed a scene of singular beauty. But it was augmented and rendered sublime by the mighty Alps, whose white and shining pyramids and domes towered above all, as belonging to another earth, the habitations of another race of beings.[41]

The experience of the sublime intensified before the larger than life Alps, which "towered above all." It seems that Shelley depicts the sublime as an experience which culminates in bringing together the feminine qualities of nature (the soft, gentle and beautiful), with the masculine qualities of nature (the hard, strong and formidable). The sublime appears in the male/female unity, becoming even more apparent when the power and magnificence of the Alps enters into the scene.

Again, the sublime shows up a third time in this same section. Here, Victor continues to describe the scenery.

We passed the bridge of Pelissier, where the ravine, which the river forms, opened before us, and we began to ascend the mountain that overhangs it. Soon after we entered the valley of Chamounix. This valley is more wonderful and sublime, but not so beautiful and picturesque as that of Servox, through which we had just passed. The high and snowy mountains were its immediate boundaries; but we saw no more ruined castles and fertile fields. Immense glaciers approached the road; we heard the rumbling thunder of the falling avalanche, and marked the smoke of its passage. Mont Blânc, the supreme and magnificent Mont Blânc, raised itself from the surrounding *aiguilles*, and its tremendous *dome* overlooked the valley.[42]

Victor describes the valley of Chamounix as "more wonderful and sublime, but not so beautiful and picturesque." In this valley, we learn that there are immense glaciers, the rumbling thunder of the falling avalanche and the magnificence of Mont Blânc have replaced the fertile valleys and ruined castles. The experience of the sublime enhances as beauty wanes and grandeur and mystery grow. In this place, the reciprocal relationship between the feminine and masculine qualities of nature begins to shift. As the story continues unfolding in the presence of Mont Blânc the sublime experience intensifies.[43]

In Volume II, Chapter II, Victor continues the journey with his family and mentions the sublime two more times. The fourth and fifth references refer to the way in which nature affects Victor. He experiences feelings of elevation, consolation and ecstasy. Victor shares,

> We visited the source of the Arveiron, and rode about the valley until evening. These sublime and magnificent scenes afforded me the greatest consolation that I was capable of receiving. They elevated me from all littleness of feeling; and although they did not remove my grief, they subdued and tranquillized it. In some degree, also, they diverted my mind from the thoughts over which it had brooded for the last month. I returned in the evening, fatigued, but less unhappy, and conversed with my family with more cheerfulness than had been my custom for some time.

Being in the presence of the sublime in the natural world had a positive effect on Victor. As Macksey remarks, "we recognize the sublime not analytically but through the experience of transport (*ekstasis*)."[44] Aware of the transporting affect the sublime had on him, Victor states, [it] "afforded me the greatest consolation," "elevated me," and "subdued and tranquilized" my grief. After his encounter with the sublime, Victor is noticeably more cheerful and social. He even begins to converse with his family. However, these feelings diminish with the obscuring nature of the clouds.

> The following morning the rain poured down in torrents, and thick mists hid the summits of the mountains. I rose early, but felt unusually melancholy. The rain depressed me; my old feelings recurred, and I was miserable. I knew how disappointed my father would be at this sudden change, and I wished to avoid him until I had recovered myself so far as to be enabled

> to conceal those feelings that overpowered me. I knew
> that they would remain that day at the inn; and as I had
> ever inured myself to rain, moisture, and cold, I
> resolved to go alone to the summit of Montanvert.

It appears as though Victor's cheerful nature directly related to his ability to see the summit because once the rain and thick mists appeared Victor's "melancholy" and "depression" returned. However, Victor continues,

> I remembered the effect that the view of the
> tremendous and ever-moving glacier had produced
> upon my mind when I first saw it. It had then filled me
> with a sublime ecstacy that gave wings to the soul, and
> allowed it to soar from the obscure world to light and
> joy. The sight of the awful and majestic in nature had
> indeed always the effect of solemnizing my mind, and
> causing me to forget the passing cares of life. I
> determined to go alone, for I was well acquainted with
> the path, and the presence of another would destroy the
> solitary grandeur of the scene.[45]

Victor's description of the sublime in this section is reminiscent of the ancient Greek experience. Time spent in nature (a type of leisure) moved him into an ecstatic experience. Victor describes this experience as "giving wings to the soul," "immersing it in light and joy," and "solemnizing the mind." Victor is describing what the ancient Greeks called *ekstasis* (ecstasy). For Victor, the ecstatic experience is a direct result of beholding the power of nature. Victor highlights a chief characteristic of the Romantic writers, the power of nature to draw the human person into a type of

communion and a deeper way of knowing. When Victor is unable to behold nature, he suffers; yet, when he is able to behold nature, even when terrified, he is consoled. Victor's ability to experience ecstasy has a direct correlation to human sensibilities, specifically the sense of sight. When Victor is able to see the natural world in all its glory the sublime draws him into an ecstatic experience. However, when he cannot see the natural world in all its glory, he loses his connection with the sublime.

The sixth time Victor mentions the sublime appears in Volume III, Chapter II. While sojourning with his childhood friend, Henry Clerval, Victor arrives in Oxford and begins to reminisce about the past, while also anticipating his future.

> I enjoyed this scene; and yet my enjoyment was embittered both by the memory of the past, and the anticipation of the future. I was formed for peaceful happiness. During my youthful days discontent never visited my mind; and if I was ever overcome by *ennui*, the sight of what is beautiful in nature, or the study of what is excellent and sublime in the productions of man, could always interest my heart, and communicate elasticity to my spirits. But I am a blasted tree; the bolt has entered my soul; and I felt then that I should survive to exhibit, what I shall soon cease to be—a miserable spectacle of wrecked humanity, pitiable to others, and abhorrent to myself.[46]

Here, Victor describes nature in terms of "beauty" and the production of man as "excellent and sublime." He articulates that "what is beautiful in nature" as well as "the study of what

is excellent and sublime in the productions of man" had the power to affect his heart and spirit in a positive way. There are two points worth noting in this section. First, Victor refers to the sublime not in terms of the natural world, but to the "productions of man," i.e., *techné* (technology). Victor is stating a key insight. Technologies have the possibility of inspiring us. They can "interest our hearts" and communicate "elasticity to our spirits." However, in order to do so, technology must align with what is excellent and sublime. Second, Victor is remembering his childhood, a time of openness and availability. When Victor is open and available to the sublime, he experiences the ensuing benefits. Conversely, when Victor manipulates nature to his liking, a "bolt enter[s] [his] soul," closing him off from receiving its gift.

It is not Victor but, rather, it is his creature, who utters the final iteration of the word sublime. The Creature, while arguing with Walton on board his ship, defends the sincerity of his mourning the death of his creator.

> Yet I seek not a fellow-feeling in my misery. No sympathy may I ever find. When I first sought it, it was the love of virtue, the feelings of happiness and affection with which my whole being overflowed, that I wished to be participated…Once my fancy was soothed with dreams of virtue, of fame, and of enjoyment. Once I falsely hoped to meet with beings, who, pardoning my outward form, would love me for the excellent qualities which I was capable of bringing forth. I was nourished with high thoughts of honour

and devotion. But now vice has degraded me beneath the meanest animal. No crime, no mischief, no malignity, no misery, can be found comparable to mine. When I call over the frightful catalogue of my deeds, I cannot believe that I am he whose thoughts were once filled with sublime and transcendent visions of the beauty and the majesty of goodness. But it is even so; the fallen angel becomes a malignant devil. Yet even that enemy of God and man had friends and associates in his desolation; I am quite alone.[47]

The creature laments his loss and all hope of experiencing love and family. The tragedy here is that the creature had potential. He held within himself, "the love of virtue, the feelings of happiness and affection." He was aware of "the excellent qualities which [he] was capable of bringing forth." Note the intelligence of the creature – he learns language, and recites the writings of Dante, Milton, Plutarch, and von Goethe - and his caring nature - chopping wood and shoveling snow to ease the work of the De Lacey family. The creature also demonstrates his moral intelligence. He names his immoral deeds, calling them a "frightful catalogue" and juxtaposes these deeds with his earlier thoughts, which were "filled with sublime and transcendent visions of the beauty and majesty of goodness." Here, the creature associates the sublime with transcendence, beauty and goodness. Even though the creature's outer form was monstrous, deep within it lay Beauty, Goodness and Truth waiting to be realized, awakened and loved into existence. Victor Frankenstein's ego, and the fear it produced, not only shuts him off from experiencing the

fullness of the sublime, it also shuts off his creature from experiencing the fullness of the sublime as well. The result is a technology so abhorrent and dangerous that even Victor, his creator, cannot behold and contemplate it. Consequently, what ensues is the total devastation and annihilation of Victor and all those he loved.

Throughout the novel, the word, sublime, is associated with multiple words and phrases including: beauty, wonderful, elevated, affording the greatest consolation, ecstasy, giving wings to the soul and allowing it to soar from the obscure world to light and joy, sanctifying the mind, excellence and goodness. However, the sublime is not in the objects themselves; it is always in the viewer's subjective experience. This is Victor's grave mistake. As master scientist, focused solely on calculative and qualitative answers, he closes himself off from the contemplative dimension of the sublime. Victor represents the human mind, detached from the human heart, what C. S. Lewis called "Men without chests."[48] Unlike the famous artist and sculptor, Michelangelo, who *listened-in-to the beings of* things in order to free David from the stone, Victor Frankenstein, as biological-mechanistic-technological scientist, is not interested in being at leisure; he is not interested in *listening-in-to the beings of* things. His sole pursuit is on production.

> I pursued nature to her hiding places. Who shall conceive the horrors of my secret toil, as I dabbled among the unhallowed damps of the grave, or tortured the living animal to animate the lifeless clay?... I collected bones from charnel houses; and disturbed,

> with profane fingers, the tremendous secrets of the human frame.[49]

Victor refuses to behold the monstrosity of his own creation, perhaps because it mirrors back to him the monstrosity of his own ego. Engaged fully in the active life, Victor has lost the contemplative dimension of life, exalted by the ancient Greeks and extolled by the Romantics.

In truth, one cannot create without the sublime; however, one can create without awareness of the *wholeness* of the sublime. Herein lies my point. When Victor creates, he does so lacking the understanding of the *full and complete* nature of the sublime. When Victor seeks to conquer and manipulate the sublime, rather than work *with* the sublime, the result is partial and appears monstrous. What is true for Victor's creation is true for us as well. When we create technologies from a limited understanding of the whole-holy nature of the sublime, we create horror and set ourselves up for danger. Only with a whole-holy relationship with the sublime can human beings create technologies that enhance the beautiful, the good and the excellent, uplift the mind, and give wings to the soul.

Heidegger, speaking in the milieu of the 20th century cautioned, "Technological advances will move faster and can never be stopped. In all areas of his existence, man will be encircled ever more tightly by the forces of technology. These forces, which everywhere and every minute claim, enchain, drag along, press and impose upon man…"[50] Certainly, Victor's technological creation imposed upon his life "claiming it, enchaining, dragging, and pressing" upon him.[51]

In the light of the contemporary culture of the 21st century, the questions for us are: Are our technological inventions doing the same? Are we no longer living with openness to the mystery?[52] Are we diminishing aura?[53] Are we losing our connection to the saving power?[54] Are we losing freedom in an ever-increasing technological world?[55] In sum, are we losing sight of the sublime, the essence of life itself and the wisdom imbued within? *Frankenstein* is more than a warning that, "technology is dangerous," it is both a reminder and an invitation to contemplate and create technologies *with* the sublime, not *from* the sublime. As Einstein realized, "We cannot solve our problems with the same thinking we used when we created them." When we live in right relationship with the sublime our souls are elevated, inspired and transported to higher states of consciousness where we can solve technological issues and create whole-holy technologies that enhance human life and the natural world.

In the twenty-first century, what type of relationships are we going to foster with our technologies? Are we going to let them disempower us, chain and drag us? Are we going to go down the path of Victor Frankenstein and manipulate nature for our own selfish purposes? Are we creating technologies that objectify humans, animals and the natural world for financial gain and self-serving ends? On the other hand, are we contemplating the hidden potential inherent in life and working in communion *with* the sublime to create technologies that dignify and enhance life in all its forms? These are the questions for readers to ponder as they reflect on the technologies of today. In addition, in academia,

scholar-teachers and administrators can contemplate the funding and research available for STEM projects in relationship to the funding and research available for the Humanities. Are we helping students to recognize the sublime and encouraging them to cultivate right relationship *with* the sublime? As we continue to produce technologies, we are called to contemplate the sublime, the human and the technological and bring them into dialogue. "We cannot lose our soul in a technological world because the soul is the essence of the human person."[56] Although both Victor and his creature lived soul-destroying lives, we do not have to. We can learn from reflecting on this wisdom tale and remember that technology is always revealing something deeper; it "is [never] simply a means to an end, it is a *way of revealing* the world we live in."[57] What are our technological inventions revealing back to us?

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[1] See Bräbbström (2006) 7.

[2] See Heidegger (1966, 46) in, "The Memorial Address." Heidegger describes calculative thinking as thinking that "computes, ever new, ever more promising and at the same time more economical possibilities…it races from one prospect to the next…never stops, never collects itself."

[3] Labor, as a purposeless activity, was also a concern of Marx.

[4] Ibid, 47. Heidegger notes that man is, "a *thinking*, that is, a *meditative* being," and he describes meditative thinking as the ability to "demand more practice…it dwells on what lies close and meditate on what is closest; upon that which concerns us, each of us, here and now."

[5] Bartlett (2007/2008) section 19.

[6] Shelley (2012) 168.

[7] Ibid.

[8] While vacationing in Switzerland, Mary Shelley had been struggling to come up with a ghost story. She, Percy and their friends had remained indoors due to the inclement weather and passed their time reading and telling ghost stories and had decided to come up with their own.

[9] See Heidegger (1966) 50.

[10] Shelley (2012) 43.

[11] Shelley (2012) 168.

[12] Ibid., 33.

[13] Maritain, quoted in Carl Mitcham (1994) 127.

[14] Shelley (2012) 45.

[15] Ibid.

[16] See Blake, Coleridge, P.B. Shelley and Wordsworth, all of whom explored the sublime in their writings.

[17] Maarten, Delbeke, Jürgen, Pieters, Caroline van Eck, et al. (2012) 2.

[18] Des Pres (1983) 136.

[19] See Nightingale (2001) 29.

[20] Aristotle (2003) 270.

[21] Shiffman (2015) 27-28.

[22] See, *The Nicomachean Ethics* X, 7 (1177b 4-6). In Greek, the word for "work" (*ascholia*) represented one who is not at leisure. On the other hand, *schole* referred to someone at leisure.

[23] See Josef Pieper (1988, 9) who quotes Aquinas saying, "Every art is called *liberal* which is ordered to knowing; those which are ordered to some utility to be attained through action are called *servile* arts."

[24] Ibid., 11.

[25] Perrin (2010).

[26] Herbert (2013) 146.

[27] Macksey (1993) 915.

[28] Ibid., xxxvi, 69.

[29] Bates (1961) 82.

[30] Day (1996) 186.

[31] Burke (1990) 53.

[32] Ibid., 136.

[33] Ryan (2001) 266.

[34] Kant (1911) 52 and 63.

[35] Kant (2010) 438.

[36] For example, Moses, though terrified, stays with the sublime at the burning bush, as he is awakened and transformed. Though terrified, Arjuna also stays with the sublime in the revelation of Krishna and as a result is gifted a fuller realization of life.

[37] Taylor (2007) 339.

[38] Ryan (2001) 265.

[39] In ancient texts, the number, seven, is considered a completion number. Although I do not know if this was Shelley's intention, the fact that the word, sublime, is mentioned seven times does point to the wholeness of the sublime present within the story.

[40] Shelley (2012) 64.

[41] Ibid.

[42] Ibid., 64-65.

[43] In this mountain scenery, Mary Shelley calls upon Percy Bysshe Shelley's poem, "Mount Blanc," which he wrote in 1816, a year before her publication of *Frankenstein*. In it, P.B. Shelley describes that, while gazing on the mountain, he is drawn into a "trance sublime and strange." Both Mary and P.B. Shelley highlight the importance of contemplation, gazing and beholding as pathways to enter into an experience with the sublime. In doing so, they both incorporate a specific technique used by the Romantic poets as described by Abrams (1984). Abrams states, "The speaker begins with a description of the landscape; an aspect or change of aspect in the landscape evokes a varied but integral process of memory, thought, anticipation, and feeling which remains closely intervolved with the outer scene. In the course of this meditation, the lyric speaker achieves an insight, faces up to a tragic loss, comes to a moral decision, or resolves an emotional problem. Often the poem rounds upon itself to end where it began, at the outer scene, but with an altered mood and deepened understanding which is the result of the intervening meditation." (76-77).

[44] Macksey (1993) 930.

[45] Ibid.

[46] Ibid., 114.

[47] Shelley (2012) 160.

[48] Lewis (1974) 25.

[49] Shelley (2012) 33-34.

[50] Heidegger (1966) 51-52.

[51] A few years after *Frankenstein* was published, Percy Bysshe Shelley wrote a poem titled, "The Triumph of Life," in which Shelley depicts many of the great human beings as chained to a chariot. Only two people, Socrates and Jesus, remained free from the chariot's chains because each refrained from taming "their spirits to the Conqueror." They remained humble before the sublime, allowing its "living flame" to shine forth through them; neither Socrates nor Jesus tried to grasp the sublime's power and manipulate it to their egotistical desires.

[52] See Heidegger (1966) 50.

[53] On this see Benjamin (1969) "The Work of Art in the Age of Mechanical Reproduction" in *Illuminations*.

[54] See Heidegger (1977) 28-29.

[55] See Nancy (1994).

[56] A comment offered during a conversation with friend and colleague, Fr. Warren J. Savage.

[57] On this see O'Brien (2004) 14.

Varieties and Dynamics of Moral Repugnance: Prediction Markets and Betting on Matters of Life and Death

Daniel Weijers and Vadim Keyser
Sacramento State University

Abstract

In this paper, prediction markets that encourage traders to bet on matters of life and death are used to explore the varieties and dynamics of moral repugnance. We define moral repugnance as morally charged feelings of revulsion that correspond (correctly, incorrectly, and indeterminately) to moral reasons and contexts. Rich variations of moral repugnance and their dynamic qualities are presented by investigating the contextual frames in which they arise. These contextual frames constitute interacting conditions composed of information about states of affairs, moral reasons, and feelings of revulsion. Through careful study of two medical prediction markets that encourage betting on death, we can observe the interaction between these causal conditions to see *how* the varieties of moral repugnance emerge. We also

present three interesting results that arise from analyzing the dynamics of moral repugnance in response to prediction markets. First, a prediction market can elicit several conflicting types of moral repugnance at the same time. Second, moral indeterminacy can arise in two different ways when judging prediction markets. Finally, some prediction markets can generate a moral endogeneity problem, a disruptive feedback loop between a given prediction market and the morally relevant outcome it predicts.

Keywords: repugnance, moral repugnance, prediction markets, betting on death, moral indeterminacy, endogeneity problem, CrowdMed, Iowa Electronic Health Markets

Introduction

Betting on matters of life and death is widely considered to be morally repugnant, which is to say that the idea of such betting causes many people to feel morally charged revulsion. Consider celebrity death pools, in which people bet (and win real money) on lists of famous people that they expect to die in the next year. Breitbart and Ebner (2004) identify the death pool website www.stiffs.com[1] as the most extreme case of schadenfreude that they have seen, pointing out that the website is replete with jokes at the expense of the deceased. For example, the site announced the death of Albert Broccoli with the quip: "Just as well. It's awful to think of anyone spending the rest of his days as a vegetable." Indeed, to say that the site is unashamedly disrespectful of the dead is an understatement. The site's homepage informs us that:

Moral Repugnance

"We've got multiple games, email alerts when the famous ones hit the dirt, and tons of other sick fun for the whole family. Come on in and have a look around ..." (www.stiffs.com).

Clearly not everyone finds betting on matters of life and death repugnant, since some people bet on death pool websites. But small numbers of people do many strange and, in the eyes of the vast majority, immoral things. Important here, is that the vast majority of people find betting on matters of life and death repugnant and they judge it to be immoral. Furthermore, widespread repugnance about betting on matters of life and death occurs even when the betting will not influence those life and death matters in any way. Of course, if the betting *is* thought to influence the life and death matters, then it is even more widely viewed as repugnant.[2]

We use prediction markets in this paper to showcase the varieties and dynamics of moral repugnance that can arise from betting on death. Modern prediction markets are websites in which anonymously registered traders buy and sell shares in predictions about real-world outcomes (Weijers 2013a). Prediction markets usually pay out a set fee (e.g., $10) to traders who hold shares in a prediction that turns out to be true. For example, a trader might purchase shares in the prediction that 'there will be a power outage affecting at least 1 million people in the United States in 2013' for $2 per share because she thinks that the shares are under-priced—that such a power outage is more likely than 20% ($2/$10 = 20% chance). If the trader holds on to the shares (instead of selling them to another trader), then she stands to make $8 per share

if the prediction is true, or lose $2 per share if the prediction turns out to be false.

In this discussion, prediction markets that encourage traders to bet on matters of life and death are used to explore a moral phenomenon—moral repugnance, which constitutes morally charged feelings of revulsion that correspond (correctly, incorrectly, and indeterminately) to moral reasons and contexts. We present rich variations of moral repugnance and their dynamic qualities by investigating the contextual frames in which they arise. The prediction market-user relation determines sets of causally interacting conditions composed of information about states of affairs, moral reasons, and feelings of revulsion, collectively labelled 'contextual frames'. These contextual frames determine the varieties of moral repugnance that emerge from a prediction market. Through careful study of a given prediction market we can observe the interaction between these conditions to see *how* the varieties of moral repugnance emerge.

In this paper, we provide a classificatory scheme of varieties of moral repugnance and analyse the dynamics of repugnance within prediction markets by *systematically* tracking shifts in contextual frames. We also present three interesting results that arise from analyzing the dynamics of moral repugnance in response to prediction markets. First, a prediction market can elicit several conflicting types of moral repugnance at the same time. Second, moral indeterminacy can arise in two different ways when judging prediction markets. Finally, some prediction markets can generate a moral endogeneity problem, a disruptive feedback loop

between a given prediction market and the morally relevant outcome it predicts. When the moral endogeneity problem affects a prediction market, the information used to make a bet in that prediction market determines the predicted likelihood of the event, which, in turn, affects the morality of using the information to make the bet. Although we exclusively use prediction market examples, the following discussion of the varieties and dynamics of moral repugnance could be applied to many social and ethical issues.

The structure of the paper proceeds as follows. In Section 2, the varieties of repugnance are discussed, especially as they pertain to complex moral information and contextual frames. In Section 3, two kinds of prediction markets that encourage betting on matters of life and death are explained in terms of contextual frames. These are prediction markets that predict epidemics and prediction markets that predict medical diagnoses. In Section 4, three important results are discussed: conflicting moral repugnance, indeterminate moral repugnance, and the moral endogeneity problem. Finally, Section 5 summarises the paper and discusses the implications.

2. The Varieties of repugnance and 'contextual frames'

Leon Kass (1998, p. 687) described repugnance as: "[when] … we intuit and feel, immediately and without argument, the violation of things that we rightfully hold dear." Kass famously defended repugnance as a source of wisdom by arguing: "Revulsion is not an argument; and some of yesterday's repugnances are today calmly accepted—though,

one must add, not always for the better. *In crucial cases, however, repugnance is the emotional expression of deep wisdom, beyond reason's power fully to articulate it.*" (Kass 1998, p. 687; emphasis added). Kass's concept refers to a context-relative violation of values. It is important to note that such a violation, in the form of general repugnance, need not be moral. For example, people may find the smell of a specific food repugnant. This is a context-relative judgment about food smells. There are often reasons associated with the repugnance, but in many cases, like food repugnance, the judgement does not occur in moral contexts or is not entangled with moral reasons. In this discussion we focus on moral repugnance, which is a specific type of repugnance in which the feelings of revulsion occur in relation to moral contexts.

Moral repugnance involves an interesting complexity: The context-relative judgment often corresponds (although sometimes not clearly) to moral reasons for making that judgment. These reasons need not be known or understood, and as such can be explicit or implicit reasons. Furthermore, we propose that moral repugnance is a relational property of a moral phenomenon. That is, moral repugnance is produced through the causal interaction between information about states of affairs, moral emotions, and moral reasons. Each causal condition will be analysed and illustrated shortly. This makes moral repugnance context-sensitive. Specifically, depending on the types of information, emotions, and reasons within a given context, the repugnance felt by an individual will take on a different character.[3] Moral repugnance and

context-sensitivity (sometimes referred to as 'contextual frames') are explored in detail below.

> *Moral repugnance* occurs when person X:
> feels morally charged revulsion about thing T, and this charged feeling is sensitive to the context in which moral information is presented.

The morally charged aspect of moral repugnance comes from the fact that the feeling of revulsion is about a moral issue, such as what someone (including ourselves) has or hasn't done, or may or may not do (Haidt 2001). So, moral repugnance is an intuitive feeling of revulsion that is cognitively associated with a phenomenon (the target of the moral repugnance), when that phenomenon is considered to lie in the moral domain by the person experiencing the revulsion. To adapt an example from Weijers and Richardson (2014), thinking about the hypothetical manager of Safety First Autos, who knowingly disregarded safety advice in order to raise short-term profits, is likely to elicit moral repugnance; in response to considering this case, we likely experience an intuitive feeling of revulsion and attribute that revulsion to the behaviour of the manager (which we consider to lie in the moral domain). Furthermore, this feeling emerges within the context of knowing certain information—e.g., specific information about the nature of the manager's disregard for safety.

Despite being based on intuitive feelings, which are notoriously hard to analyse with introspection (Weijers 2013b), repugnance can be morally justified by *moral reasons*. For example, Kass (1998) argues that human cloning

elicits repugnance because it is an affront to human nature and normal human reproduction. However, Kass (1998) also argues that, even when it cannot be justified, *widespread* repugnance by itself is a strong, prima facie winning, moral argument—i.e. when the majority of people find something repugnant then the burden of moral argument falls on the proponent of the thing in question. In such reason-lacking scenarios, the implicit assumption is that there is some hidden moral reason, corresponding to the repugnance. This reason need not be known at the time of the feeling of revulsion, so the argument goes, because it will likely become obvious at some point, especially if the purportedly repugnant phenomenon becomes commonplace. But it is not always the case that the assumed reasons associated with the feeling of revulsion properly correspond.

There are cases in which even widespread moral repugnance is unwise because it does not correspond to the right set of moral reasons, such as when the repugnance is based on widespread false moral or factual beliefs.[4] Even when repugnance seems like a good indicator of moral reasons, we cannot know it without carefully analyzing the reasons, and the states of affairs those reasons relate to, directly. For example, a child might find it morally repugnant that a stranger is wading in 'the sacred pool', that is, until he asks his parents about it, and hears that the stranger is the messiah, finally returned. Therefore, anyone experiencing repugnance about something should be open to receiving new information about it in order to form a more explicit judgment

based on a more complete set of moral reasons and background information.

Although some instances of moral repugnance about a phenomenon may be deep-rooted, the context-sensitive interaction between feelings of revulsion, information, and moral reasons are dynamic. By discovering certain facts, or new moral reasons, or the fact that certain moral reasons are false, we may change the feeling of moral revulsion. There is a feedback loop between emotions, information, and reasons such that small shifts in information can change the contextual-frame and the character of repugnance.

The example of the sacred pool wader from above helps to demonstrate that the contextual-frame is a dynamic entity. Recall that the boy felt moral repugnance about the act of the stranger, wading in the sacred pool. His moral repugnance is based on framing information about what the sacred pool is and the moral rules about how to interact with it. Perhaps it was considered a most vile act to touch the water of the sacred pool in any way, and so the boy believed the moral rule that it is immoral for anyone to wade in the sacred pool. Upon seeing the stranger, he immediately feels moral repugnance at the stranger's actions. But then, upon inquiring, and learning the non-moral information that the stranger is the messiah returned, the boy revises his moral reason, which, in turn, eliminates his feeling of repugnance by removing both the moral and the revulsion aspects. The boy's moral reasons changed from 'wading in the sacred pool is morally wrong' to 'the messiah can wade in the sacred pool'. And, that the person wading in the pool is the messiah returned replaces the

boy's previous background information that the wader was a stranger. The simple summary is that this shift in context, directed by the change of certain information *corrects* our initial belief-based judgment that caused our feeling of revulsion.

Since repugnance that is based on false beliefs seems clearly mistaken in relation to moral reasons, the following definition will be used for mistaken moral repugnance in this discussion:

> *Mistaken moral repugnance* occurs when person X feels moral revulsion about thing T, but careful analysis of the relevant information finds that X's moral revulsion about T is based on a false belief about T such that, if X held sufficient true, and no false, beliefs about T, then X would not feel moral revulsion about T.

So, moral repugnance is revealed to be mistaken moral repugnance when further information about T, changes the way X feels about T in one of two main ways.[5] First, the morally charged aspect might disappear, while an amoral revulsion remains, such as when a child with no knowledge of modern medicine witnesses a surgery and then, upon inquiring, has it explained to him that the surgeons are helping and not torturing the patient. The child no longer finds the surgery morally problematic, but the graphic visual display still makes her feel sick to her stomach. Or second, the whole feeling of revulsion might dissipate, such as in the sacred pool wader example above. When the boy learnt more about the situation, there was a shift in the contextual frame, and he lost

his moral concerns and his feeling of revulsion at the same time.

In both of the examples above, each child felt moral repugnance, and came to the judgment that they were observing an immoral act. If these children had not sought out more information about what they observed, then they might still feel moral repugnance, and think that the things they saw were immoral. These examples help to highlight the danger in treating even widespread moral repugnance as being an argument in a moral debate. The information that shows the moral repugnance to be mistaken might not be obvious to most people, or it might be attainable, but only after some targeted research. Indeed, cautioning against Kass's wisdom of repugnance, Roache and Clarke (2009) have pointed out that using unjustified repugnance as an argument in a moral debate can stymie the discussion by making arguments without enough substance to object to. For (at least) this reason, repugnance should be investigated by those experiencing it to see if they can justify it, to make it "legitimate". Here, "justification" and "legitimacy" will be context-sensitive to someone's moral reasons, which are derived from a moral framework.[6] A moral framework is systematic set of moral beliefs that can be reasoned through—e.g., consequentialism, deontology, and virtue ethics. This is not to be mistaken with a form of relativism. As we will see when discussing prediction markets and repugnance, moral reasons can shift between different moral frameworks but this does not mean that moral reasons are reducible to claims about subjective states or that moral reasons are a shell of moral emotions.

For the purposes of this paper, legitimate moral repugnance will be defined as follows:

> *Legitimate moral repugnance* occurs when person X feels morally charged revulsion R about thing T; and careful analysis using X's moral framework finds the set of moral reasons that correspond to R, which thus deems T immoral.

Legitimate moral repugnance designates a *process* of moral reasoning in which the feeling of revulsion begins the analytical moral search for reasons that will justify something being moral or immoral. If people experiencing moral repugnance can (reasonably) justify it with a moral framework then the repugnance should be considered legitimate and be given more weight in moral debates (assuming that the justification is methodologically careful). Such justifications should be given more weight again if they are intersubjective—i.e. generally compelling to other people. Justifications can be considered generally compelling if they only rely on background beliefs that are widespread.[7] For example, if nearly everyone finds death pools repugnant, and people's self-reflection on their moral frameworks reveals that they find death pools immoral because of, e.g., the way that they disrespect weighty matters of life and death (moral reasons), then there would be widespread legitimate moral repugnance about death pools. In this case, there is a correspondence between the repugnance and the moral reasons that we use to analyse certain information (deontological reasons in this case). Alternatively, we could weigh consequentialist reasons against consequentialist

reasons within a moral algebra. For example, given that there are few, if any, benefits from death pools that could not be sourced from elsewhere, the widespread legitimate repugnance about death pools seems to be enough to outweigh the benefits, and thereby deem death pools immoral and impermissible.

If there is widespread legitimate moral repugnance about a new technology, then proponents of the new technology can try to argue in two ways. They might try to persuade all of the people experiencing legitimate moral repugnance that their moral framework is wrong and that the correct moral framework would not deem the new technology immoral. Or, they could try to show that other moral factors within the given moral framework outweigh the repugnance— a strategy that is much more likely to be effective if the other moral factors are part of the moral framework of the people experiencing legitimate moral repugnance.

But, the opaque nature of our moral intuitions means that we will not always be able to justify our moral feelings, such as moral repugnance, accurately. Indeed, we are not always aware of how the contextual frame, as well as any shifts in that frame, can make our attempted justifications inaccurate. For example, when we judge a situation to be morally repugnant, we may have reasons that correspond to the feeling of revulsion–we may be able to justify our moral repugnance by referencing our personal moral framework. However, it is possible that the moral reasons we use to justify our moral repugnance are not in fact related to the thing we feel the repugnance about.

Jonathan Haidt has organized many experiments that run participants through this process.[8] In Haidt, Koller and Dias (1993), the researchers describe a scenario to participants (in an interview setting) in which a taboo is violated; the recently deceased family pet is eaten. Many participants are emphatic that eating the dead pet is morally wrong, citing various plausible consequentialist and deontological principles. But, in response to the cited moral principles, the researchers modify the scenario so those principles no longer apply (e.g., there is no harm for the animal, no risk of the eaters getting food poisoning, no lack of respect for the animal is experienced, etc.). "Is it still morally wrong?", the researcher would ask, after the participant's potential justifications for their moral repugnance are shown not to be relevant. It turns out that, for many participants, even though every justification they could conceive of proved not to be relevant, they could not shake their moral repugnance–their feeling that eating the family pet was morally wrong.

The above example makes no conclusions about the objective, or even culturally relative, moral status of eating the family pet, but it does demonstrate that moral repugnance can remain even if no subjective justification is available for it. If moral repugnance were a slave to moral reason, then we should expect the repugnance to dissipate, or at least lose its moral charge. However, at least in some instances, the feeling of morally charged revulsion sticks. This might indicate that there are vague, ambiguous, and/or indeterminate moral reasons behind the repugnance (moral indeterminacy will be addressed in more detail in Section 4). More simply, there may

be currently inaccessible moral reasons that correspond to the moral repugnance, but it is also possible that there are not. So, when there is a discrepancy between the feeling of moral repugnance and the moral reasons that we search for and cannot find, it is hard to know whether wisdom resides in that repugnance. As a result, sometimes one is left trying to reconcile a strong moral feeling with what rationally appears to be an *amoral* state of affairs, i.e. one without corresponding moral reasons. For the purposes of this paper, this phenomenon will be referred to as dumbfounded repugnance.

> *Dumbfounded moral repugnance* occurs when person X feels moral revulsion about thing T, but careful analysis using X's moral framework finds T to be amoral (or has nothing morally explicit to say about T).

Kass, and many others with faith in the wisdom of repugnance, probably believe that their repugnance about an act carries more weight in the argument than their inability to find a fitting reason to morally condone or condemn the act. But, this may be because they believe that the repugnance is an indicator for some deeply seated moral reasons. Indeed, without a strong argument for why an act is morally praiseworthy, or why the repugnance is misguided, anyone siding with the wisdom of repugnance seems, epistemically speaking, reasonably entitled to do so. This means that the burden of proof is on anti-repugnant moral reasoning. The reasoning here is similar to choosing a scientific method that produces false positives. With repugnance as the moral status quo, we may get cases where that repugnance is wrong (false

positive), but we will most likely get more cases in which it corresponds to the proper set of moral reasons. The contrasting strategy is to be wary of moral repugnance as an indicator of moral reasons. This has the consequence of ignoring many cases in which repugnance has moral justification that is not accessible at this time.

One benefit of allowing dumbfounded moral repugnance to play a role in moral debate about new technologies is that it encourages proponents of the new technology to make a stronger and more explicit moral case for why the new technology should be permitted, thereby decreasing the chances of permitting a potentially dangerous new technology. Indeed, like an evolved precautionary principle, our ingrained propensity to be suspicious of (and occasionally undervalue) the unknown is likely to have been adaptive for precisely the same reason—it encourages us to cautiously investigate new and potentially beneficial things. It is a call for more moral evidence, and until then it is to serve as prima facie evidence against permitting the new technology. The reasoning here is pragmatic. If we are concerned with preventing negative effects, then we will halt the technology until we see more evidence. However, as Kass rightly argues, the onus now falls on the proponents of the new technology to argue why the widespread moral repugnance is mistaken.

When people experiencing repugnance about a new technology are trying to justify it with their moral frameworks, and when they are considering arguments from proponents of the new technology, they might find that the new technology

receives a mixed verdict from their moral framework. That is to say that they can see reasons why the new technology is immoral (why they might find it repugnant), but also reasons for why it would be morally good to permit it. Three kinds of mixed verdicts deserve closer attention, starting with indeterminate moral repugnance.

> *Indeterminate moral repugnance* occurs when person X feels moral revulsion about thing T, but careful analysis using X's moral framework finds T to correspond to both immoral and morally good reasons, and, all thing considered, X's moral framework finds T to be morally indeterminate, or it cannot not pass a clear judgement on X.

Given that different kinds of moral reasons are not always easy for people to accurately weigh up, many people experiencing repugnance about a new technology may find themselves with indeterminate moral repugnance. For example, a cancer researcher who believes that the sanctity of life begins at conception might feel that there are incommensurable moral reasons both for and against permitting research on embryonic stem cells. For this researcher, we could say that their moral repugnance is justified (by the sanctity of life concern), even though they might not have a clear overall moral judgment about the permissibility of embryonic stem cell research. At first it seems that, widespread indeterminate moral repugnance about a new technology should be treated like widespread dumbfounded moral repugnance—it should play the role of prima facie evidence against permitting the new technology

and act as a call for further investigation on the part of the proponents of the new technology. However, as discussed in Section 4, because some scenarios give us incommensurable moral reasons, our only option is to either change the contextual frame to make it a case of non-indeterminate repugnance or to accept that no new information will make the moral reasons commensurable.

Another type of repugnance that receives a mixed verdict from a moral framework is mitigated legitimate moral repugnance.

> *Mitigated legitimate moral repugnance* occurs when person X feels moral revulsion about thing T, and careful analysis using X's moral framework finds T to correspond to both immoral and morally good reasons, and, all thing considered, X's moral framework finds T to be immoral.

The cancer researcher from above might also decide that, although embryonic stem cell research could help relieve suffering and save lives, the sanctity of life and the moral rule not to kill are categorical moral rules that allow for no exception. As such, the researcher's overall moral judgement would be that embryonic stem cell research is immoral. In most respects, widespread mitigated legitimate moral repugnance will play the same role as widespread legitimate moral repugnance—it should be given weight in moral debates about new technologies (and more weight than is given to dumbfounded moral repugnance).

Moral Repugnance

The final type of repugnance that receives a mixed verdict from a moral framework is outweighed legitimate moral repugnance.

> *Outweighed legitimate moral repugnance* occurs when person X feels moral revulsion about thing T, and careful analysis using X's moral framework finds T to correspond to both immoral and morally good reasons, and, all thing considered, X's moral framework finds T to be morally good.

Perhaps in a nearby possible world, the cancer researcher has a family history of several severe cancers, and has children with a high chance of contracting cancer during their lives. The researcher still believes that harvesting embryos is morally repugnant because it is killing a human life (so their repugnance is legitimate), but this time his moral framework allows for comparisons between the good of potentially curing cancer and the bad of killing. As a result, the researcher thinks that, all things considered, it should be morally permissible to conduct embryonic stem cell research. Notice here that the contextual shift of the moral framework determines the final moral outcome (moral judgment).

It should be noted that people's moral frameworks change over time, including as a consequence of moral argument or example. Any change in moral framework during the moral debate about a new technology should result in the new technology being reassessed using the varieties of moral repugnance defined above.

Although there are other varieties of repugnance,[9] the above varieties provide a sufficient framework for assessing

the dynamics of repugnance that emerge in the prediction market scenarios about betting on death, as well as most of the moral results generated from tracking how repugnance shifts in contextual frames. In the next section, the dynamics of repugnance are analyzed within prediction market scenarios. In Section 4, moral results are discussed.

3. Prediction markets and contextual frames

3.1 Prediction markets on epidemics and infectious diseases.

The Iowa Electronic Health Markets (IEHMs; http://iehm.uiowa.edu/iehm/main/) is a website that allows anyone to set up their own health-related prediction market or to bet on the existing health-related predictions. Many of the markets are designed to promote betting on epidemics—on the spread and deadliness of viruses and other infectious diseases. For example, traders can bet on "What will be the level of 2009 H1N1 [(also known as Swine Flu)] influenza mortality rate in the U.S. by the end of July 31, 2009?"[10] Since most of the markets run at the IEHMs are for "funny money"[11] (status points) instead of real money, it seems fair to say that the IEHM encourages traders to bet on matters of life and death for the fun of it. Indeed, traders will be playing a betting game in which the real-life occurrence of mass death caused by a virus outbreak could help them win.

No doubt many people find the IEHMs repugnant, and, if they tried to justify those feelings using information about IEHMs, along with their moral frameworks, they would probably suggest that the IEHMs are crossing a moral boundary by failing to show appropriate respect for the lives

and deaths of those who have been directly or indirectly affected by deadly diseases.

However, by shifting the contextual frame, using more detailed information about IEHMs, moral conclusions can shift to IEHMs being highly respectful of matters of life and death. The IEHMs website is a not-for-profit initiative with the goals of improving knowledge about prediction markets and especially making health-related predictions that help medical professionals better protect the health of people around the world (such as by providing information that enables the timely production and distribution of appropriate vaccines). Furthermore, initial reports (e.g., Polgreen, Nelson, & Neumann 2007; see also http://iehm.uiowa.edu/iehm/main/) suggest that prediction markets might be a very effective way to quickly identify the danger posed by new infectious diseases, and thereby enable a faster and more accurate response that could result in thousands of lives being saved. Since the IEHMs have the intention and likely effect of saving lives, it seems as though they are treating the matters of life and death, to which they are relevant, with a high level of respect.

The contrast here is between two contextual frames. One frame is that individuals might bet frivolously, with a lack of appropriate respect for those whose lives or deaths have been affected by infectious disease. The other frame is that the design of the IEHMs has the intention of providing accurate predictive information about epidemiological phenomena, and has proved both effective and efficient in providing such information. This market is designed with deontological as

well as consequentialist considerations. The benefits it provides go far beyond the frivolous fun of betting for no good reason. Here, the two contextual frames give us two sets of information and, thereby, two sets of moral reasons.

It is important to address that these shifts in contextual frames are determined by certain information about not only the IEHMs but also about human psychology. For example, what is the likelihood of people with frivolous intentions trading on the IEHMs? Can we conclude that it is low considering the minimal pay-offs available compared to trading on the more popularist predictions available on real-money for-profit prediction markets? Such statistical information will contribute to information about the IEHMs' disrespect for matters of life and death, and thus will contribute to the contextual frame for the likely varieties of moral repugnance about the IEHMs.

3.2. Prediction markets on medical diagnoses

CrowdMed (www.crowdmed.com) is a new online medical diagnosis prediction market that concerns some doctors (Hall 2013). People with undiagnosed and highly worrying illnesses pay CrowdMed $200 to reveal their personal medical histories to CrowdMed's M.D.s ("medical detectives"). Anyone can join CrowdMed's ranks of medical detectives in order to suggest diagnoses and bet on their own or other M.D.s' suggestions. Upon hearing a brief description of what CrowdMed does, many will find it repugnant—the idea of strangers with no medical expertise suggesting diagnoses of the most painful and deadly illnesses to

vulnerable people is likely to elicit feelings of moral revulsion in many, if not most, people. Adding to the intensity of this feeling is that the suggestions produced by the medical detectives are just that, suggestions, and might be mistaken as medical advice.

Let's develop the specific contextual frames. If people attempted to reconcile these initial bits of information about CrowdMed with their moral frameworks, it is likely that they would come up with at least one of the two following justifications. First, they would likely claim that CrowdMed is repugnant because it recklessly encourages untrained traders to suggest high-stakes medical diagnoses to vulnerable people in a way that puts these people at risk of further emotional and physical damage (e.g., by not pursuing further professional medical advice). This would clearly violate the oath to do no harm taken by many doctors around the world. Second, they would likely claim that CrowdMed is repugnant because whether or not someone has a deadly illness is a weighty life and death issue that should be treated with the utmost respect, not gambled on frivolously by curious strangers. Reasons can be grouped into consequentialist reasons, focusing on negative outcomes (e.g. increasing harm of patients), as well as deontological reasons, focusing on moral principles and virtues (e.g. manipulating someone's autonomous decisions). Examining information from a different perspective about how CrowdMed works, however, reveals a possible shift in contextual frame.

CrowdMed does rely on the verdicts of unscreened "medical detectives", but apparently not in a reckless way or

a way that takes advantage of the vulnerable. The end result of medical detectives' trading on CrowdMed is a short list of possible diagnoses (often of rare diseases) based on the medical detectives' trading behaviour in the market. CrowdMed is explicit that these potential diagnoses should then be taken to a medical professional to discuss them and possibly arrange for the relevant diagnostic tests. So, CrowdMed does not steer its "patients" away from professional medical care. This means that autonomy is respected. In fact, this can be seen as a way to give individuals more options. Indeed, it seems likely that people will only use CrowdMed *after* they come to realise that the medical professionals in their area cannot properly diagnose their problem. Furthermore, CrowdMed then immediately directs their patients back to professional medical experts. With this information, we can make a judgment about the intentions behind the design of CrowdMed. The intended purpose of the design seems to be to respect individuals and provide possibilities.

Now for the consequential analysis. Although CrowdMed charge $200 to its patients, this does not mean that they are preying on the vulnerable. According to their website, CrowdMed refunds the $200 if none of the suggested diagnoses are correct, making patients' use of CrowdMed financially favorable. Furthermore, if one of the suggested diagnoses is correct, then CrowdMed has likely saved the patient thousands of dollars in further medical examinations (not to mention the health benefits, since CrowdMed claims to be highly accurate; www.crowdmed.com/faq).

Moral Repugnance

Assuming CrowdMed is accurate, and considering the description of CrowdMed above, then any repugnance felt about CrowdMed because of a belief that it is reckless, or takes advantage of the vulnerable, seems mistaken. Indeed, the way in which CrowdMed's prediction market on medical diagnoses seems to empower the vulnerable, rather than take advantage of them, makes it appear to be the opposite of reckless. Given this information within this contextual frame, if people feel that CrowdMed is repugnant *solely* because it recklessly endangers vulnerable people, then their repugnance appears to be mistaken.

But even people who believe that CrowdMed has good intentions in its design and that CrowdMed's prediction market on medical diagnoses seems to be beneficial to most patients, might still find the idea of betting on painful and deadly diagnoses repugnant because it does not appropriately respect that this is potentially a matter of life and death for the patient. Here, we are yet again shifting contextual frames. We are moving from the frame that takes into account the intentions behind the design, and also from the frame that takes into account the beneficial consequences. The current frame takes into account information from the patient's individually-located perspective to juxtapose it with the fact that CrowdMed's operation is powered by betting. How can we respect this as a matter of life or death if betting is involved? For example, CrowdMed's medical detectives could be betting for amusement or the glory of being the most accurate predictor—motives that are disrespectful considering that people's lives are at stake. So, it seems that the betting-

on-matters-of-life-and-death aspect of CrowdMed is legitimately repugnant because it does not appropriately respect the lives and potential deaths involved.

It might change our contextual frame again if we learn the information that CrowdMed's medical detectives win money for correctly predicting diagnoses, but also that the money goes to a charity, which allocates it to a real patient (of the medical detectives' choice) who needs financial support to treat their illness. But this bit of information changes the feeling of repugnance only if our moral framework has certain exceptions. For example, if betting on human lives is intrinsically immoral, does it change the nature of the bet to know that good consequences will result for human lives (e.g., in the form of more donations for medical treatment)? This brings us to an interesting point: Maybe we can prevent shifts in contextual frames. Why can't we just amalgamate all of the information in the frames to get complete information? The answer is explored in the next section.

4. Results of applying contextual frames to prediction markets

There are several important results that arise from applying the dynamics of moral repugnance to prediction markets. First, a prediction market can elicit several conflicting types of moral repugnance at the same time. Second, moral indeterminacy can arise in two different ways when judging prediction markets. Finally, some prediction markets can generate a moral endogeneity problem, a

disruptive feedback loop between a given prediction market and the morally relevant outcome it predicts.

4.1 Levels of information and multiple moral frameworks

Prediction markets offer a vast space to observe the dynamics of moral repugnance. We have seen how moral repugnance shifts from mistaken moral repugnance to legitimate, back to mistaken, depending on the contextual frame. The first question is, why can't we prevent the shift, stabilize the contextual frame? The simple factor that prompts the contextual shift is the range of perspectives, and this factor cannot be eliminated. As we saw in the previous section, both the IEHMs and CrowdMed appear to have respectful intention in their design. That is, they seem to be designed to respect autonomy (e.g., by providing predictive information and options), as well as generate results that will help individuals. However, from the perspective of an individual that is involved in the life threatening event or condition, the juxtaposition between someone betting on your personal situation and the way that you experience that situation does not necessarily translate to the so-called respectful intention in the design of the prediction market. This is not merely unjustified offense. Rather, it points to the minimal level of treatment many of us would expect from others when care about our lives is involved; we expect our living or dying not to be part of a betting game, even when that game has benefits. Perhaps, we expect to be treated like humans rather than pawns. There are numerous other perspectives available. The careless better, for example, or the careful better, and so on.

Importantly, these perspectives are not compressible into one simple perspective. There is also no invariant perspective that is foundational to every perspective. As such, we don't get a view from nowhere about these prediction markets. Rather, the prediction market-user relation produces layers of perspective, which are mostly incommensurable. Each layer offers a different set of information, each of which can determine different moral reasons. The interesting result is that while these perspectives exist simultaneously within the prediction market-user relation, the user may only be able to adopt one at a time because of the incommensurable information.

Even if we were to choose one perspective over the others, this would still not help us reach a single contextual frame. This is because background information is not the only multi-layered feature of a contextual frame. There are multiple moral frameworks users can adopt. A person who subscribes to a different moral theory to another person may reach a contradictory moral judgment based on exactly the same non-moral information. As discussed in Section 3, we can take the consequentialist approach, which focuses on the output of successful prediction. And, we can take the deontological approach, which focuses on concepts like autonomy, no matter what the consequences are. These perspectives are usually interpreted as offering incommensurable frameworks for analyzing moral phenomena. Sometimes the results overlap, but the *processes* of moral reasoning do not. We could choose one framework over the other, but then we face an empirical ethical problem: have we represented all of the

relevant moral parameters in the scenario? In the prediction market scenarios in Section 3, the shift between moral frameworks occurred by ignoring certain information. But this is rarely an option when trying to generate a complete representation of a moral scenario. For example, we might want to take into account aspects of human choice as well as the consequences (for individuals and populations). So, like the information perspectives, the macro-level moral framework perspectives are also numerous. Furthermore, these different moral perspectives will likely exist simultaneously in the prediction market-user relation, meaning that they are all accessible as possible moral frameworks to evaluate moral parameters of the prediction market. Perhaps, because of the incommensurable moral principles in each moral framework, a user may only be able to adopt one at a time, but individuals can change their moral frameworks, and multiple individuals can occupy the prediction market-user relation at any one time.

4.2 Indeterminacy

In Section 3, contextual shifts were discussed in relation to mistaken moral repugnance and legitimate moral repugnance. Outweighed legitimate moral repugnance and mitigated legitimate moral repugnance work in the same way as legitimate moral repugnance, with one small addition; there is a conflict in moral reasons. But the conflict is resolved by one's moral framework. For example, sometimes such conflicts are resolved because certain factors are given a larger value in the moral algebra—e.g., successfully predicting the

outbreak of a disease in a population is more important than preventing selfishness and gain in betting on the outcome of the outbreak. Mistaken, legitimate, mitigated, and outweighed moral repugnance all share the fact that there is a determinate outcome in which something is decided to be moral or immoral. However, there is another type of repugnance that produces a puzzling scenario.

Indeterminate moral repugnance occurs when careful analysis of conflicting reasons yields moral indeterminacy. This is different from dumbfounded moral repugnance, in which careful analysis determines something to be amoral. For the purposes of this paper, the nature of indeterminacy has to do with a relation between information, moral reasons, and revulsion.[12] Specifically, indeterminate repugnance is a process in which some conflicting combination of feelings, information, and moral frameworks interact in order to produce an output that has no determinate moral value. An interesting feature of indeterminate moral repugnance is that when we go through the process of careful analysis, we gain more relevant information, but unlike the other varieties of moral repugnance discussed here, the resulting moral judgment becomes less determinate.

One way to manufacture indeterminate moral repugnance is simply to keep the information limited. This way, the judgment cannot be passed on. We can keep any amount of moral information unknown—e.g., the intentions of agents, the consequences for individuals and populations, and the success of the market in generating information—thus making a concrete moral judgment difficult to reach until that

the missing information is known. This may seem extreme, but there are many unknowns when judging a prediction market. For example, what is the exact success rate of CrowdMed and IEHMs' predictions in a particular subdomain? What are the majority of these prediction market users really like? Are they careless gamblers, thoughtful do-gooders, or bored individuals? In such cases, indeterminate moral repugnance takes form because of unknowns. But, there are other cases in which there is adequate information and indeterminate repugnance still takes shape.

Indeterminate moral repugnance can also occur when whether or not to implement the prediction market takes a form similar to many traditional moral dilemmas. For example, imagine a prediction market in which traders are encouraged to bet on matters of life or death, but implementing the market would considerably bolster conservation efforts. In cases like this, we might have all of the information we need; but some people will still find the prediction market morally indeterminate because they find the moral reasons on either side incommensurable. Someone might value conservation very highly, while also finding betting on life and death morally repugnant, and believing conservation and appropriate respect for matters of life and death to be impossible to trade off against one another.

4.3 The moral endogeneity problem

Claims that prediction markets would not work are mainly based on the endogeneity problem faced by some kinds of markets (e.g., Stiglitz 2003, Richey 2005). Generally,

'endogeneity' refers to a causal loop between two variables. We apply this to endogeneity in the stock market to demonstrate the general form of the endogeneity problem. Then, we use this form to present a new moral endogeneity problem.

Market prices are often used to ascertain the actual value of something because it is thought that the actual value of the thing in question sets the market price (in relation to extant supply and demand). For instance, the share price of a firm in a stock market should be set by the real-world value of the firm (in relation to extant supply and demand). The endogeneity problem occurs when the market price affects the thing in question, and often its actual value (Birchler & Facchinetti 2007). This kind of endogeneity can be problematic because it warps the incentives for trading in the market. Indeed, endogeneity can sometimes warp the incentives to such an extent that traders will avoid the market entirely. But, this is true only when the betting of a trader has an effect on some prediction being accurate.

Imagine a trader betting money that their best friend will discover a treasure, and the more that trader knows about the accurate spot of the treasure, the less likely it becomes for that trader's best friend to discover it. The reason why it becomes less likely is because bets are public entities, so any information provided can shift the final outcome, given that the final outcome can be affected by the betting activity. Richey (2005) argues that if well-informed traders were very confident that a particular prediction was accurate, then the endogeneity of the market might dissuade them from buying

shares in the prediction because buying shares in the prediction increases the price, and, depending on the prediction in question, increasing the price is likely to change someone's real world behaviour in a way that increase the chances that the prediction will *not* come true.

We can apply the endogeneity problem to the dynamics of repugnance. Prediction markets face a moral endogeneity problem, where the information used to make a bet can determine the likelihood of the event, which determines the morality of using information to make the bet. This only works for prediction markets where the likelihood of the event can be affected by the bet. For example, suppose that we bet on how likely it is for a person to get sick while in a high-risk flu area. Further, suppose that we choose these individuals by real names and make this information publically accessible so that the individuals can see that they are being betted on. Let's imagine that Sal Harrington, who doesn't have the greatest immune response during the wintertime, is one of these individuals. Tray Der knows this about Sal and bets that he will likely become hospitalized due to the flu. Sal becomes aware of the bet on his health at the same time the public does. Determining the likelihood of Sal getting sick just by betting on Sal can be simple: People attempt to get Sal sick.[13] Or maybe Sal will develop the nocebo effect, where Sal's negative expectation produces negative physiological results in the form of stress hormones and a weakened immune response.[14] Either way, the likelihood of the event is influenced by the bet. But even more interesting is the fact that the morality of using information to

make the bet is influenced by the likelihood of the event, which is influenced by the information used to make the bet. So, because Tray Der knows something about Sal, which makes Sal more likely to get sick, it becomes more immoral for Tray to use this information. This illustrates the moral endogeneity problem produced by prediction markets. Such a problem creates a feedback loop between information, likelihood of events, and morality, which can only be broken if the link between information and likelihood is broken. Additionally, we may not know if a given prediction market has an endogeneity problem until the prediction market is up and running.

5. Concluding Remarks

We have explored the varieties and dynamics of moral repugnance by characterizing the relationship between feelings of moral revulsion, information about states of affairs, and moral reasons within moral frameworks. By presenting a new model and classificatory scheme for repugnance in terms of contextual frames, we illustrated the dynamic shifts in repugnance, and applied these shifts to prediction markets, including the real markets, CrowdMed and the Iowa Electronic Health Markets. Three interesting results were discussed about analyzing the dynamics of moral repugnance within prediction markets. First, a prediction market can elicit several conflicting types of moral repugnance at the same time. Second, moral indeterminacy can arise in two different ways when judging prediction markets. Finally, some prediction markets can generate a moral endogeneity problem,

a disruptive feedback loop between a given prediction market and the morally relevant outcome it predicts.

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[1] If you want to know if you are famous enough to be (to quote from www.stiffs.com) "good to go", then you can check the celebrity database here: www.stiffs.com/celebrity/directory/. Several academics make the list.

[2] Some forms of death pools, such as a death pool in Taiwan about when local elderly people will die, plausibly influence the deaths of the people who are bet on because those who care for the elderly can participate and have considerable financial incentives to withhold life-saving care. See: "Betting on when late-stage cancer patients would die, doctors and family members wagered over 1 billion [TWD]" for a discussion and comments by readers expressing repugnance. Available from:
http://www.chinasmack.com/2013/stories/underground-gambling-on-when-cancer-patients-will-die-exposed.html.

[3] Here, we are not committed to our model being realist or antirealist. It might be that there is a corresponding truth that these context-relative judgments can latch on to. We are not concerned with this. Rather, we are concerned with the relation between information, moral emotion, and moral reasons, and how those factors interact to produce varieties of repugnance. As we will see in section 4, this account may have an aspect of perspectival realism, where different perspectives are indispensable in giving us certain information to make moral judgments.

[4] See Kimberly (2002) and Niemela (2011) for further opposition to the wisdom of repugnance.

[5] Similarly, there is a way in which further information about a context, as opposed to a thing (e.g. new technology), can

also change the way that someone feels about that thing. For example, imagine that a man wearing a crass shirt is presenting information on the benefits of human cloning and some people in the audience (who are unfamiliar with the possibility of human cloning) feel revulsion. Although the sickened audience members cannot quite put their finger on the reason for why they find human cloning morally repugnant, they are certainly feeling revulsion, and human cloning is both a moral issue and the likely cause of their feeling of revulsion. However, it is possible that the audience members are not emotionally affected by the idea of human cloning at all–they are not moved by any moral reasons or lack of moral reasons in relation to human cloning whatsoever. Instead, they have been unwittingly repulsed by the presenter's crass shirt, and have been mistakenly attributing that unjustified repugnance to the potentially morally relevant idea of human cloning. However, when the presenter stops talking, and turns off his presentation, the audience members take more notice of his shirt, and realize that it is the cause of their feelings of revulsion. The audience members gain more amoral information about the context, which leads them to realize that their judgment of moral repugnance was mistaken; they were simply experiencing sartorial revulsion.

[6] The justification need not appeal to a correspondence theory of moral truth. Our focus is the process of moral reasoning rather than the final outcome of the moral reasons latching on to some moral truth. However, we do focus on the correspondence between moral reasons and information about states of affairs.

[7] Here, we say that this is an 'indicator' of translation between frameworks because it may be that everyone just has one moral framework. It may also be that there is merely the coincidence of moral results without translation. These effects are not detrimental to the concept of legitimate moral repugnance, so we accept the indicator as being just that.

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[8] See Bjorklund, Haidt, and Murphy's (2000) as well as Haidt, Koller and Dias (1993) for this process of eliminating reasons but failing to eliminate the feeling of repugnance.

[9] *Conflicted moral repugnance* occurs when person X feels moral revulsion about thing T, but careful analysis using X's moral framework finds T to be (only) morally good.

  Dominant moral repugnance occurs when person X feels moral revulsion about thing T, but careful analysis using X's moral framework finds T to be morally good, and X revises their moral framework (ensuring that T is deemed immoral) to accommodate their repugnance. *Moral repugnance deficit* occurs when person X feels no revulsion about thing T, but careful analysis using X's moral framework finds T to be immoral.

[10] See: http://iehm.uiowa.edu/iehm/markets/published/swine_mortality_0908.

[11] See: http://iehm.uiowa.edu/iehm/content/faq/.

[12] Metaphysical issues about indeterminacy will not be discussed here. See Schafer-Landau (1995) for a helpful discussion on alethic and comparative indeterminacy.

[13] Imagine something like the most corrupt sports betting—where bets sometimes rely on mechanisms for injuring the players during preseason just a little in order to ensure that the team suffers just enough for the bet to be won.

[14] See June et al. (1997).