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## Imagination in the Stars: The Role of the Imagination in Artistic Astronomical Photography

Stephen Chadwick

### Abstract

In this article I discuss the role the imagination plays in the production of what I call artistic astronomical photographs. I examine the entire creative process, which has been defined as "that stretch of mental and physical activity between the incept and the final touch."<sup>[1]</sup> I begin with an examination of some of the ways in which the imagination is exercised in traditional artistic photography and in observational painting, in order to tease out the similarities and differences. Following a brief explanation of the way artistic astronomical photographs are produced, I examine these similarities and differences and, in doing so, show the unique ways in which the imagination is exercised in this form of photography. I go on to explain that this is because of the nature of its subject matter. I conclude by demonstrating that, although the imagination plays this unique role in artistic astronomical photography, this does not compromise its photographic integrity.

### Key Words

aesthetics; astronomical photography; imagination; observational picture; painting

### 1. Artistic and scientific astronomical photographs

There has been some discussion of astronomical photography in the literature of aesthetics but, for the most part, it has concentrated on photographs taken by professional scientific observatories, such as the Hubble Space Telescope (HST).<sup>[2]</sup> The ultimate purpose of these observatories is to capture data for scientific research, and the spectacular photographs that have been released for public consumption, processed by members of the Hubble Heritage Project, are really just a by-product of this.<sup>[3]</sup> A spokesperson for the project said, "[By] emphasizing compelling HST images distilled from scientific data, we hope to pique curiosity about our astrophysical understanding of the universe we all inhabit."<sup>[4]</sup> They might therefore be regarded as "public outreach photographs."<sup>[5]</sup> Elizabeth Kessler praises them and points out that many "bear a striking resemblance to earthly geological and meteorological formations, especially as depicted in Romantic landscapes of the American West."<sup>[6]</sup>

However, it must be emphasized that, for aesthetic effect, the colors in some of these photographs are represented arbitrarily and, in many cases, data from wavelengths beyond the visible range are assimilated. Consequently they are sometimes referred to as false color images.<sup>[7]</sup> This fact has prompted commentators to question whether they truly represent reality and, if they do not, whether they should just be considered "pretty pictures."<sup>[8],[9]</sup> As Martin Kemp says, "[T]he 'eye' of Hubble is very much not a human eye. And the translation of its 'perceptions,' some 370 miles into space, into brilliant cosmic landscapes which are accessible to our visual system requires a level of contrivance even greater than that of a traditional landscape painter."<sup>[10]</sup> As they are a by-product of scientific data, I call this category of astronomical photographs scientific astronomical photographs. Figure 1 is an example of such a photograph taken by the HST.

What these discussions have overlooked, however, is the fact that, over the last fifteen years, modern digital technology has progressed to such an extent that astronomical photographs, with aesthetic properties, can now be taken by non-scientists using consumer-grade cameras and optics often similar to those used by mainstream photographers.<sup>[11]</sup> Furthermore, these photographs are not produced for scientific reasons at all but are "purposefully made in order to capture, engage and sustain aesthetic experience" and it is for this reason that I call them artistic astronomical photographs.<sup>[12]</sup> In this article, I restrict the discussion to these sorts of astronomical photographs so that a fair comparison can be made with what I call traditional artistic photographs, which are all non-astronomical photographs that are made for aesthetic, not scientific, reasons. Figure 2 is an example of an artistic astronomical photograph.



Figure 1. Orion Nebula. (Photograph courtesy of NASA)



Figure 2. Orion Nebula. (© Stephen Chadwick)

I do not, however, include nightscapes in this discussion. Although these often contain an astronomical element, usually the Milky Way, they are more akin to landscape photographs, as an essential contributor to their aesthetic success is the terrestrial foreground.<sup>[13]</sup> The subjects of the sorts of astronomical photographs that I wish to discuss are purely astronomical and include nebulae, star clusters, and galaxies. These are the most interesting from a philosophical point of view because they are largely devoid of the subjects of traditional artistic photography. I must add that this article concentrates solely on digital photography, partly because digital has largely superseded film in most realms of photography but, more importantly, it is only by virtue of digital technology that artistic astronomical photographs can be taken.<sup>[14]</sup>

## 2. The imagination

Although the imagination is extensively discussed in philosophical aesthetics and art criticism, it is usually through its role in the aesthetic appreciation of works of art. This is not, however, the concern of this article, for I am interested in the role of the imagination in the creation of works of art. Defining the imagination is not easy, as it is used in many different ways in common parlance and in the literature of aesthetics.<sup>[15]</sup> However, Berys Gaut offers a useful analysis that seems particularly applicable to the way it is exercised in the creation of photographs. He says, "[I]magination is free from commitments to what is the case and to particular actions...As such, imagination is peculiarly suited...to be the vehicle for active creativity, since one can try out different views and approaches by imagining them, without being committed either to the truth of the claims or to acting on one's imaginings."<sup>[16]</sup> This means that the "imagination allows one to be playful, to play with different hypothesis, and to play with different ways of making things."<sup>[17]</sup>

Gaut characterizes four types of imagination: propositional, objectual, experiential, and dramatic.<sup>[18]</sup> While propositional imagination, that is, entertaining a proposition without committing to its truth value, is obviously central to all human pursuits, it is the phenomenologically rich experiential imagination that is the main concern of this article.<sup>[19]</sup> Experiential imagining

is "the kind of case where imagining has a distinctive experiential aspect," and, in relation to photography, this experiential aspect is particularly visual and can be referred to as visual imagining.[20] It also should be acknowledged that imaginings can be both spontaneous and deliberate. Kendall Walton says, "[We] sometimes decide on what to imagine...we form intentions to imagine this or that and carry them out. Imagining is sometimes deliberate. But not always. Often we just find ourselves imagining certain things. Our fantasizing minds stray, seemingly at random, without conscious direction. Thoughts pop into our heads....Like breathing, imagining can be either deliberate or spontaneous." [21]

In this article I compare the way the imagination is exercised in the production of artistic astronomical photographs with the way it is exercised in the production of other observational pictures.[22] An observational picture is one that is derived from the artist's immediate observations of the world. Paintings can be observational if they depict the scene that lay in front of the artist during the painting process.[23] Obviously not all paintings are observational, as it is possible to paint completely imaginary scenes or realistic scenes derived purely from memory. Furthermore, even when a painting is observational, it is not necessarily realistic, that is, it does not necessarily closely resemble the scene as it would have appeared to an observer standing next to the artist. For the artist is free to paint the scene in whatever way it appears to them, and the imagination plays a crucial role in this. As Jonathan Friday says, sometimes, "as in the case of impressionists and surrealists, this manifests itself in a picture representing visual experience of the world rather different from ordinary perceptual experience." [24]

For example, Van Gogh's *Wheat Field with a Lark* (1887) is an observational painting, as the artist was painting that which was before him in a field outside Asnières (Figure 3). But an observer standing next to him would not have perceived this scene as it is depicted in the final painting, for we all perceive and imagine the world in different ways. This explains, along with variations in talent, why different observational paintings of the same scene are never identical.



Figure 3. Vincent Van Gogh, *Wheat Field with a Lark* (1887).

Traditional artistic photographs are, on the other hand, always observational pictures, as they are formed from the light captured from the intentionally framed portion of the real world that was in front of the lens when the shutter was released. I will show, however, that as with an observational painting this does not mean that the resultant photograph will closely resemble the scene as it would have appeared to an observer who stood next to the photographer. For, by using the imagination, the photographer can control how the scene is represented in the resulting photograph.

Artistic astronomical photographs are also essentially observational pictures as they are likewise formed from the light captured from the intentionally framed portion of the real world that was in front of the lens when the shutter was released. However, I will show that, because of the nature of their subject matter, they differ substantially from the previously mentioned types of observational pictures, and this has an important effect on the unique way that the imagination is exercised in their production. To accomplish this it is important to first examine the way the imagination is exercised in the production of these other observational pictures.

### 3. Imagination in observational painting

So what role does the imagination play in the creation of an observational painting, a painting that is of something that lies in front of the painter? While it must be acknowledged that all painters work in different ways, there are at least some common ways in which the imagination is exercised that are central to the creative process. What we find is that spontaneous and deliberate imagining is used in four important ways.

First, visual imagining is central to the choice of subject or scene, and the perspective from which it is to be painted. As Walton says, objects in the environment act as "prompters" and it is these that "prompt our imagination."<sup>[25]</sup>

Second, imagination plays an important role in deciding which fine details of the scene to depict in the final painting. So, for example, the portrait painter can choose not to include the necklace that hangs around the subject's neck, or the landscape painter is free to ignore the horse that is grazing in the field.

Third, the artist may imagine that the painting will be enhanced if some elements are *added* to the scene. For example, the painter may imagine that the portrait will be preferable if a necklace is depicted, even though the subject is not wearing one, or the country scene may be rendered more tranquil with the addition of an imagined horse.

The fourth important use of the imagination concerns how the scene is to be depicted in order to portray the artist's intention. This will involve the choice of colors, shades, brushstrokes and so on, all of which might be influenced by the conventions held by the school of art to which the painter may belong.

This is by no means an exhaustive list, and is not necessarily exercised sequentially, for there is constant interplay among all four ways throughout the whole creative process.

#### 4. Imagination in traditional artistic photography

There are many philosophers who have argued that, in some sense, photography is mechanical and causal, and that, furthermore, it is this that distinguishes it from other pictorial art forms, such as painting. For example, Walton famously claims that "objects cause their photographs and the visual experiences of viewers mechanically," while Robert Hopkins says "photography...involves a causal chain free from the influence of people's beliefs and experiences."<sup>[26],[27]</sup> For André Bazin, it is this mechanical characteristic that accords photography a kind of realism that distinguishes it from other kinds of pictures.<sup>[28]</sup> Walton also says, "[P]hotographs are counterfactually dependent on the scenes they portray: if the scene had been different the photograph would have been different," which leads to his transparency thesis that states that "photographs are *transparent*. We see the world *through* them."<sup>[29],[30]</sup>

If this mechanical view of photography is correct, it would surely follow that the imagination plays a lesser role in the photographic process as compared to its role in observational painting. However, as I will show, photography is, in fact, far from mechanical, and thus the imagination plays an extremely important role, as we see if we consider the four uses of the imagination explored in the previous section.

1) The imagination is used by the photographer to decide what will make a good subject and from what perspective it should be presented. Experiential visual imagining is central at this point because the photographer has to visualize how a particular part of the scene in front of him or her will appear in a photograph and in what way this will engage the viewer. Choosing the correct lens is especially important as it is focal length that determines field of view. As Gordon Graham says, "[T]he more imaginative a photographer is, the more he or she is likely to select a point of view which, left to our own devices, we would not have chosen," and so "the photographer gets us to see what we would not otherwise have seen."<sup>[31]</sup>

2) As explained earlier, in the case of observational painting once the scene has been chosen, the painter has complete control over which parts to include. For example, if the portrait painter does not wish to include the necklace that hangs around the subject's neck, then he or she is at liberty to preclude it from the painting. By altering camera settings, this control is also afforded photographers. First, by varying the aperture they can adjust the depth of field, which results in different parts of the scene appearing in and out of focus in the resultant photograph. By using this method it is sometimes possible to blur some objects in the scene to such an extent that it is impossible for the observer of the resultant photograph to know what they are. Second, by altering the exposure length it is possible to effectively remove objects and features from the scene all together. Consider Bill Brandt's *Nude* (Figure 4). It is highly likely that the woman represented in this photograph had some skin blemishes, and it surely goes without saying that she had a neck. However, by the expert choice of exposure these features have effectively been removed from the resulting photograph. So, just as the painter can decide not to include the necklace around the neck in the portrait, the photographer can do the same in the photographic portrait, and in both cases visual imagining is central to the achievement. What this shows is that the imagination plays an important role in what fine details are depicted, and so the resulting photograph is very much dependent upon the photographer's intentions and imagination.



Figure 4. Bill Brandt, *Nude*, 1952.  
(Courtesy of the Bill Brandt Archive and the V&A)

3) The observational painter is, of course, at liberty to add elements to the painting that are not present in the scene in front of him or her. For example, while painting a landscape the painter may include an imaginary horse, and this is why, when we observe the finished painting, we suspend our judgement as to whether or not there was an actual horse before the painter. However, this does not seem to be true for traditional artistic photography for, as Savedoff says, "If there is a horse in a photograph, we assume that there must have been a horse in front of the camera, since the horse cannot be a product of the photographer's imagination."<sup>[32]</sup> A photographer may imagine that the tranquility of the countryside would be enhanced by the presence of a horse but, without actually getting a horse to enter the scene, there will not be a horse in the resulting photograph. As a consequence of this, we can say that, for something to be considered a genuine photograph, it is a necessary condition that if objects are depicted in it, then that which caused their depiction must have been in front of the camera when the shutter was released. It seems, therefore, that in relation to traditional artistic photography, this third use of the imagination plays no part. Later, I will discuss adding objects into photographs during the processing.

4) What about the fourth way that the imagination is exercised by the observational painter? I have explained that once the painter has chosen the scene and the elements that are to be depicted, including ones to be added, the painter exercises imagination in order to depict this in a way that fulfills his or her aesthetic intention. In order to achieve this, they have to choose colors, shades, brushstrokes, and so on. Is there an equivalent use of the imagination in traditional artistic photography, or is the creative process complete with the release of the shutter?

Releasing the shutter is, in fact, far from the end of the photographic procedure, for this action does not actually produce a photograph. Rather, during the period of time that the shutter is open, all that occurs within the camera is that the sensor detects the photons that arrive from the scene and converts them into an electrical charge. As I have explained elsewhere, in order for a photograph to be produced, the raw data that have been collected by the sensor have to be processed by software. There are two ways in which this can be achieved.<sup>[33]</sup> The most straightforward is to use the camera's own firmware, the software that is installed into the camera itself. This firmware is written in such a way as to translate the settings that have been chosen by the photographer and apply them to the raw data that was captured by the sensor.<sup>[34]</sup> If the photographer wishes, however, this internal firmware can be bypassed and the raw data downloaded onto an external computer and processed manually.<sup>[35]</sup> Doing so affords the photographer the capability to alter many aspects of the photograph, such as colors, shades, contrast, and sharpness. This fourth use of the imagination is, therefore, extremely important in both traditional artistic photography and observational painting.

However, as Jiri Benovsky says, "[I]f the image has been 'tampered with,' one could ask...does it still count as a *photograph*? Are digitally modified photographic images still photographs, or are they some sort of 'digital pictures based on a photograph,' or not even that?"<sup>[36]</sup> As we have seen, all digital photographs are digitally modified and manipulated, and this is "an

essential and necessary feature of the process of production of digital photographs."<sup>[37]</sup> But, intuitively, there does seem to be a limit to how much tampering can be undertaken before they lose genuine photographic status, although where this limit lies is hard to determine. As Benovsky points out, the "problem here is a problem of vagueness: there is a limit to the type and amount of retouches that a digital photograph can be altered with while still remaining a photograph, but it is a vague, underdetermined, and indeterminate one."<sup>[38]</sup>

For example, our intuitions tell us that if a photograph of the Taj Mahal is slightly brightened or the color of the grass in the foreground is made a little more vibrant, then it remains a photograph of the Taj Mahal. On the other hand, if it is lightened to such an extent that the scene becomes completely white or the grass is presented as pink, then our intuitions tell us that it ceases to be a genuine photograph of the Taj Mahal. However, while this limit is indeterminate, there does seem to be a vague objective measure that guides our intuitions, for we can at least compare the photograph with how we would expect the depicted scene to appear to the naked eye. If the photographic representation diverges too much from this natural look, then we feel photographic integrity is compromised and it just becomes a digital observational picture based on a photograph.

However, although using software to manually alter color balance, contrast, and so on might seem acceptable up to some vague and indeterminate point, can the same be said when data are actually added to or subtracted from the photograph? Using software to subtract data from a photograph, for example, removing pimples from the face of a model, is common practice and, again, up to some indeterminate point, we do feel that photographic integrity is preserved. Things seem somewhat different, however, if software is used to add data. For example, the landscape photographer could copy a horse from another photograph and superimpose it onto a photograph, thus adding the tranquility that he or she originally imagined prior to releasing the shutter. Our intuitions here suggest that photographic integrity is compromised if any data are added. The reason for this is because, as we have seen, for something to be considered a genuine photograph, it is a necessary condition that if objects are depicted in it, then that which caused their depiction must have been in front of the camera when the shutter was released. It follows from this that, if an object is added in the processing stage, then photographic integrity is compromised and it just becomes a digital observational picture based on a photograph.

We are now in a position to turn to the issue of how the imagination is used in the production of artistic astronomical photographs. What I will show is that the way the imagination is used here differs somewhat from the way it is used in the production of both observational paintings and traditional artistic photographs, and this arises from the unique nature of astronomical subjects and the way that the photographs are created. However, I will also show that this does not compromise their photographic status and, as with traditional artistic photographs, they are likewise observational pictures.

##### **5. The creation of artistic astronomical photographs**

So what is so unique about the subjects of artistic astronomical photographs? Crucially, most extended astronomical subjects, such as nebulae and galaxies, are too faint to be visible to the naked human eye.<sup>[39]</sup> Furthermore, this is not because of their vast distances from us and thus their apparently small size in the sky. For although they would appear larger the closer they were to us, their brightness would extend over a larger area and so their average brightness would actually remain constant. They are, therefore, intrinsically too faint to be visible to the naked eye. The only reason that the colors, shapes, and forms of extended astronomical subjects appear in photographs is because digital cameras, in conjunction with long exposures, can detect so much more light than can be detected by the naked eye. It is this characteristic of astronomical subjects that impacts on the way the imagination is exercised in the creative process. To understand this, it is important to have some understanding of the way the light that is captured by the sensor is converted into a final photograph.

In the last section I explained that, in the case of traditional artistic photography, this can be achieved automatically, via the camera's own firmware, or manually, on an external computer. However, the astronomical photographer cannot rely on automatic software because it is written with the aim of processing data gathered from the kinds of subjects that we encounter in everyday life. Consequently the only way to produce artistic astronomical photographs is to process the data manually on an external computer. As astronomical subjects are very faint, most of the detail is hidden in the shadows; Figure 5 shows an unprocessed astronomical photograph of the Pleiades star cluster, and, at this point, the only parts that are visible are the very brightest stars.

The first step that the astronomical photographer needs to take is to brighten the photograph so that the brightest and the darkest parts of the scene are visible concurrently. The whole photograph cannot simply be brightened linearly because, if it is, the brightest parts become too intense and all contrast is lost, as shown in Figure 6. Rather, through numerous tiny increments, the photographer has to choose which parts of the scene to brighten and which parts to keep dark, in order to produce a photograph that satisfies his or her

aesthetic aim. However, as most of the scene is imperceptible to the naked eye, this cannot be used as an objective guide to ensure that the relative brightness across the photograph is correct. Rather, at each step of the brightening process, the photographer has to visually imagine what relative brightness levels will satisfy his or her overall aesthetic aim.



Figure 5. The Pleiades, unprocessed. (© Stephen Chadwick)



Figure 6. The Pleiades, brightened linearly. (© Stephen Chadwick)



Figure 7. The Pleiades, brightened non-linearly.  
(© Stephen Chadwick)

Once the relative brightness across the photograph has been accomplished to the satisfaction of the photographer, the colors need to be balanced. In terms of traditional artistic photography, color balance is usually relatively acceptable straight from the camera. This is because the hardware and software are designed in such a way as to produce photographs with colors that closely resemble what we perceive with the naked eye. If the resultant color balance does not fulfill the aesthetic wishes of the photographer, it can be altered in processing software, which is fairly straightforward, as the photographer can use the colors we perceive in the world around us as an objective guide.

The situation is very different, however, for the astronomical photographer, for as the colors of astronomical subjects are imperceptible to the naked eye, they

cannot be used as an objective guide to achieve a correct color balance. From the data that have been collected by the camera, it is obvious which parts of the scene contain the most red, green, and blue but there is no objective way of determining which shades they should be. This greatly affects the resultant secondary colors and hence the overall appearance of the final product. As was the case with brightness, in order to balance the colors satisfactorily, it is necessary for the photographer to make subjective decisions prompted by the imagination. Thus, as with observational paintings, no two astronomical photographs of the same subject will ever be the same, even if the same person repeatedly processes the same data. One such end result derived from the data shown in Figure 5 is seen in Figure 7.

#### 6. Imagination in artistic astronomical photography

Let us now consider the four uses of the imagination in relation to astronomical photography.

1) The first use of the imagination concerns the choice of subject. In the cases of observational painting and traditional artistic photography, the “prompters,” that which prompts the imagination, are objects and scenes perceived in the world around us.<sup>[40]</sup> However, as the features of astronomical subjects are imperceptible to the naked eye, they cannot directly act as prompters. Rather, what directly prompts the imagination are photographs of astronomical subjects, for it is only once such subjects have been photographed that they can properly be examined. In order to accomplish this, the astronomical photographer has to take short test exposures of possible subjects. The results are extremely rough and grainy, as can be seen in Figure 8, which is a short exposure of a nebula with the catalogue name, Sharpless 308. Using these test exposures as a guide, and by exercising visual imagination, the photographer is able to visualize which subject will deliver the intended aesthetic experience once the final photograph is produced. Figure 9 shows the final result as inspired by the test photograph shown in Figure 8.

Of course, some of the most famous astronomical subjects have already been photographed many times by different people, and so these can also be used for inspiration. But, as we have seen, because of the subjective decisions that have to be made during the processing stage, the appearance of such photographs can differ significantly. So pre-existing photographs can only ever be used as a rough guide to subject choice. Ultimately, visual imagining that is prompted by photographs is crucial to subject choice, and this differs substantially from the way it is exercised in subject choice in observational painting and traditional artistic photography. This does not, however, alter their status as observational pictures for, as is the case with all photographs, the end result is derivative of the light that was observed by the camera during the exposure.



Figure 8. Test exposure of Sharpless 308. (© Stephen Chadwick)



Figure 9. Final processed version of Sharpless 308.  
(© Stephen Chadwick)

2) In terms of using the imagination to effectively remove objects from the scene, I explained that the observational painter has total freedom. Similarly, prior to the release of the shutter, the traditional artistic photographer has substantial control over this by altering the lighting conditions and exposure length and by exploiting depth of field by adjusting the aperture. The artistic astronomical photographer, on the other hand, does not have this freedom for two reasons. First, because of the large distances to astronomical subjects, they are all at infinity in relation to the photographer, and so depth of field cannot be exploited. Second, as astronomical subjects are relatively faint, long exposures are essential in order to maximize the amount of light hitting the sensor in the camera. Thus the astronomical photographer cannot and, furthermore, would not wish to effectively remove elements from the resultant photograph in this way.

3) In the third use of the imagination, I showed that observational painters are at liberty to add elements to the scene that is in front of them. However, I went on to argue that it is a necessary condition for something to be considered a photograph that, if an object appears in the photograph, that which caused its depiction must have been in front of the camera when the shutter was released. As a consequence of this, photographic integrity is not maintained if data are added during the processing stage. This very point is what lies behind the charge that scientific astronomical photographs are really just pretty pictures. For the public outreach photographs that are created as a by-product of data acquired from scientific observatories often do have data added to them in the processing stage, specifically to enhance their aesthetic appeal. This third use of the imagination is, therefore, very much at work in the production of scientific astronomical photographs, and it is this that changes their status from genuine photographs to observational digital pictures based on photographs. This is not, however, the case with artistic astronomical photographs, because these can be created without adding data. Thus, because the imagination is not exercised in this third way, photographic integrity is, at least *prima facie*, maintained.

So far I have argued that, in relation to artistic astronomical photography, the imagination is uniquely exercised in terms of the choice of subject, it cannot be used at all for removing fine detail from the scene, and it should not be used for adding data if photographic integrity is to be preserved. Does this mean that the imagination only plays a minor role in the creation of astronomical photographs? This is, in fact, far from the case because of the fourth way that the imagination is exercised.

4) While discussing traditional artistic photography I explained that, in relation to color balance, brightness, sharpness, and so on, there is a vague, indeterminate limit to how far they can be altered before photographic integrity is compromised. I argued that while this limit is indeterminate, there is a vague objective measure that guides our intuitions, for we can compare the photograph with how we would expect the depicted scene to appear to the naked eye. If a photograph diverges too much from this natural look, then we feel photographic integrity is compromised and it becomes just a digital observational picture based on a photograph. However, in relation to artistic astronomical photographs, this objective measure does not exist because the scene is intrinsically imperceptible to the naked eye. There is, therefore, no way of knowing whether such a photograph has diverged too much from the natural look to ensure photographic integrity is maintained. This is obvious if we compare the photographs in Figures 8 and 9.

The absence of this objective criterion might suggest that anything goes when processing artistic astronomical photographs, and so the fourth way that the imagination is exercised is similar to the way it is exercised by the observational painter. For, in the case of the painter, there is no objective criterion that must be observed when choosing how to portray the scene, and so he or she is able to use the imagination freely. If this is the case, then this surely means that artistic astronomical photographs are not genuine

photographs at all but are just digital observational pictures based on photographs.

However, this is not the case for two reasons. First, in contrast to the observational painter and in common with the traditional artistic photographer, the artistic astronomical photographer can only work within the confines of the light that has been captured by the camera. Second, there is a vague objective standard that guides the processing of the photographs, albeit one that is different from that used in traditional artistic photography, and this arises from a basic understanding of some of the scientific mechanisms that underlie astronomical subjects. For such knowledge enables the astronomical photographer to make some broad decisions as to which parts of the photograph to depict the brightest, where it is suitable to use contrast and sharpening, which general colors are appropriate, and so on. It is, therefore, an understanding of scientific mechanisms that guides our intuitions when it comes to deciding whether a particular astronomical photograph is genuine or should really just be considered a digital observational picture based on a photograph.

## 7. Conclusion

In this article I have shown that the way in which imagination is exercised in the production of artistic astronomical photographs diverges significantly from the way it is used in other forms of observational picturing, which arises from the fact that its subjects are largely imperceptible to the naked eye. First, unlike in observational painting and traditional artistic photography, subject choice is dependent upon other photographs rather than the scene as directly perceived by the artist. Second, the imagination cannot be exercised to effectively remove objects from the scene. Third, and in common with traditional artistic photography but contrary to observational painting, the imagination cannot be exercised in order to add things to the scene if photographic integrity is to be maintained.

Lastly, although there is much subjectivity in the way artistic astronomical photographs are processed, it is not the case that the imagination can be unrestrained, as with observational painting. For, in accordance with traditional artistic photography, there is a vague objective criterion that must be adhered to if photographic integrity is to be maintained. However, the criterion that guides our intuitions differs greatly in these two forms of photography. Because of their imperceptibility, it is a scientific understanding of astronomical subjects that guides our intuitions when it comes to deciding whether a particular astronomical photograph is genuine or whether it should really just be considered a digital observational picture based on a photograph. Whereas, in the case of a particular traditional artistic photograph, no scientific knowledge of its subject matter is required in order to decide whether photographic integrity is maintained; all we need to know is how far the scene that is depicted diverges from the way it would appear to the naked eye. Finally, observational painters do not require any scientific knowledge of that which lies before them and, furthermore, their imagination is not restricted by the way the scene appears to the naked eye.<sup>[4]</sup>

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Stephen Chadwick lectures in philosophy and astronomy at Massey University in New Zealand and is also a respected astronomical photographer. His first book, *Imaging the Southern Sky*, was the first of its kind, and his forthcoming book, *Starlore and Astronomy of the South Pacific*, explores other aspects of the aesthetics of astronomical photography. Many of his photographs are on his website: [www.southernskyimaging.com](http://www.southernskyimaging.com).

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## End Notes

[1] Monroe C. Beardley, "On the Creation of Art," *Journal of Aesthetics and Art Criticism*, 23, 3 (1965), 291-304; ref. on 291.

[2] The most comprehensive discussion is Elizabeth Kessler, *Picturing the Cosmos: Hubble Space Telescope Images and the Astronomical Sublime* (Minnesota: University of Minnesota Press, 2012).

[3] M. Lynch and S. Edgerton, "Abstract Painting and Astronomical Image Processing," in *The Elusive Synthesis: Aesthetics and Science*, ed. A. I. Tauber (Netherlands: Kluwer Academic Publishers, 1996), pp. 120-123.

[4] Hubble Heritage:  
<http://heritage.stsci.edu/commonpages/infoindex/ourproject/moreproject.html>  
(accessed November 9, 2016).

[5] Shana Cooperstein, "Imagery and Astronomy," *Leonardo*, 47, 2 (2014), 129-134; ref. on 131.

[6] Elizabeth Kessler, *Picturing the Cosmos: Hubble Space Telescope Images and the Astronomical Sublime* (Minnesota: University of Minnesota Press,

2012), p. 5.

[7] Travis Rector, "Image-Processing Techniques for the creation of Presentation-Quality Astronomical Images," *The Astronomical Journal* 133 (2004) 1-104; Ref. on 39.

[8] Anya Ventura, "'Pretty Pictures:' The Use of False Color in Images of Deep Space," 19 (2013). See also M. Lynch and S. Edgerton, "Aesthetics and Digital Image Processing," in *Picturing Power*, eds. Gordon Fyfe and John Law (London: Routledge, 1988), pp. 184-221.

[9] Evan Snider, "The Eye of Hubble: Framing Astronomical Images," *FRAME: a Journal of Visual and Material Culture* 1 (2011): 3-21. See also Elizabeth Kessler, "Resolving the Nebulae: The Science and Art of Representing M51," *Studies in History and Philosophy of Science* 38 (2007), 477-491.

[10] Martin Kemp, *Seen/Unseen* (Oxford: Oxford University Press, 2006), p. 242.

[11] For a detailed discussion see Stephen Chadwick and Ian Cooper, *Imaging the Southern Sky* (New York: Springer, 2012).

[12] Jonathan Friday, *Aesthetics and Photography* (Aldershot: Ashgate Publishing Limited, 2002), p. 33.

[13] Examples of this form of photography can be found in Michael Shaw, *The Complete Guide to Landscape Astrophotography* (England: Focal Press, 2017).

[14] While astronomical photographs taken with film were certainly extremely important scientifically, it is unlikely that most people would claim that they had much aesthetic value. For a collection of such photographs, see David Malin & Paul Murdin, *Colours of the Stars* (Cambridge: Cambridge University Press, 1984).

[15] See Leslie Stevenson, "Twelve Conceptions of Imagination," *British Journal of Aesthetics* 43 (2003), 238-259.

[16] Berys Gaut, "Creativity and Imagination," in *The Creation of Art*, eds. Berys Gaut & Paisley Livingston (Cambridge: Cambridge University Press, 2003), pp.148-174; ref. on 160.

[17] *Ibid.*, p.161.

[18] *Ibid.*, pp.152-154.

[19] *Ibid.*, p.152.

[20] *Ibid.*, p.154.

[21] Kendall L. Walton, *Mimesis as Make-Believe* (London: Harvard University Press, 1990), pp.13-14.

[22] Drawings, sketches, etchings and so on can also be observational pictures. For simplicity, I use paintings as the exemplar of this genre.

[23] For an excellent discussion of painting from observation, see John Danvers, *Picturing the Mind* (New York: Rodopi, 2006).

[24] *Ibid.*, p.14.

[25] Kendall Walton, *Mimesis as Make-Believe* (London: Harvard University Press, 1990), p. 21.

[26] Kendall Walton, "Transparent Pictures: On the Nature of Photographic Realism," *Critical Inquiry* 11 (1984), 246-277; ref. on 251.

[27] Robert Hopkins, "Factive Pictorial Experience: What's Special about Photographs?" *Nous* 46 (2012) 709-731; ref. on 710.

[28] André Bazin, "The Ontology of the Photographic Image," *Film Quarterly* 13 (1960), 4-9.

[29] Kendall Walton, *Marvelous Images: On Values and the Arts* (Oxford: Oxford University Press, 2008), p.127.

[30] Kendall Walton, "Transparent Pictures: On the Nature of Photographic Realism," *Critical Inquiry* 11 (1984), 246-277; ref. on 251.

[31] Gordon Graham, *Philosophy of the Arts* (New York: Routledge, 1997), p. 52.

[32] Barbara Savedoff, "Digital Imagery and the Resources of Photography," *Journal of Aesthetics and Art Criticism* 55 (1997), 201-214; ref. on 202.

[33] See also Jiri Benovsky "The Limits of Photography," *International Journal of Philosophical Studies* 22 (2014), 716-733.

[34] If this method is chosen then the imaginative decisions made by software engineers also become directly involved in the production of the final photograph.

[35] For an in-depth outline of this process see Jiri Benovsky "The Limits of Photography," *International Journal of Philosophical Studies* 22 (2014), 716-733.

[36] *Ibid.*, p. 720.

[37] *Ibid.*, p. 721.

[38] *Ibid.*, p.724.

[39] Extended astronomical subjects do not include planets and stars that would appear brighter the closer they were to us. There are some extended subjects that are visible to naked eye, such as the Magellanic Clouds and the Andromeda Galaxy.

[40] Kendall Walton, *Mimesis as Make-Believe* (London: Harvard University Press, 1990), p. 21.

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