Encountered astronomy: Aesthetics and authenticity in the public communication of science

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Abstract

Within what we call "encountered astronomy" there is a discrepancy between images that can be visualized while looking through a small telescope—whether in an observatory or in a backyard—and images obtained with professional equipment—digital cameras, professional telescopes, or those sent back to Earth from space-based telescopes and space probes. As Michael Lynch suggested, this discrepancy is a known problem for the public communication of astronomy. Astronomer guides in public observation of the sky sessions engage in practices to manage the disappointment of visitors who expect to see remarkable images of celestial objects. This paper explicates bases for guides' work through considerations of "aesthetics" and "authenticity". Astronomer guides normalize the divide between telescopic viewing and the achieved spectacles of astrophotography. A corpus of video-recordings of star parties occasioned a reconsideration of a range of Lynch's studies, which afford reflection on contextures in relation to astronomy education settings and the vastness of Space.

INTRODUCTION

"The public communication of science" glosses communication between scientists and funding agencies, popular science magazines/websites, or the general public (Lynch and Edgerton 1988). Our paper narrows the "public communication of science" to astronomy. We suggest that the interface between astronomers and non-astronomers—astronomers guiding members of the public through astronomy communication and education sessions in schools, observatories, planetariums, etc.—present opportunities for us to look at a place where science and aesthetics meet. Guides are aware that for many, this may be their first encounter with astronomy apart from stylized schemata of constellations, e.g. join-the-dot picturing of Ori-

on as a hunter (Lynch and Edgerton 1997), or the colourful filigree representations found on websites and in magazines. As such, guides provide an "authentic" astronomy experience (Sudnow 1984, 43); but this authenticity does not deliver the images of Space found in popular culture (Chen 2017). An interactional problem in the face-to-face public communication of astronomical science is immediately presented, to manage expectations and disappointment (Marques and Retrê 2023).

Figure 1: Infrared pictures of different observations of the sky recorded for this study. Credits: the authors

From our inspection of video-recorded data, an ordinary, regular feature of astronomy outreach sessions is the expression of emotion by visitors. Emotional expressions characterize the experience of taking a turn at a telescope, whether these expressions are of frustration (not being able to see through the telescope), of indifference (not finding the sight remarkable), of disappointment (when the visualized object does not meet expectations) (Marques 2023), or of wonder (when the visualized object surpasses expectations) (Marques et al. 2023). Our goals in this paper are not to survey nor reiterate the range of emotions that we have identified as experienced or expressed in astronomy outreach sessions, tailored to what we variously call "altered expectations", "expectation management"[1], or the "management of disappointment", and subsequent ramifications. Without looking at observational astronomy in its technical details, the auspices of this study are narrowed to the public communication of astronomy in star parties and other activities of observation of the sky.

Since the foundational statements explicating the details of the discovering sciences (Garfinkel 2022), ethnomethodology has been concerned with the practices of scientists in their technical specifics.[2] Rather than treating science or discovering science as a gloss, ethnomethodological studies of science characterize the work of discrete sciences: that scientists are engaged not just in "physics" but in "experimental physics"; and not just in "experimental physics" but in "scanning tunnelling microscopy"; not just in "scanning tunnelling microscopy" but this particular instance of it (Sormani 2014, 2022). Our study is concerned broadly with "astronomy", which provided a worksite for one of the early "studies of work" (Garfinkel et al. 1981), as a research team followed recordings of scientists' measurement of anomalies

1 As Douglas Macbeth (personal communication) confirmed for us, "expectations" and "disappointment" are "tied" together; yet the import of the relation between these responses to astronomical phenomena may be the success of other, prior science education endeavours.

2 Our reference to "foundational statements" refers to the historicity of the collaborative manuscripts upon which this book was based. With thanks to Michael Lynch for editing these for publication.

in space that were realized as a pulsar. More specifically, we shall look at astronomy education and public communication of astronomy. A corpus of video-recordings filmed in Portugal allows us to look closely at the collaborative work of astronomer guides and visitors and to draw attention to the authenticity of astronomy and astronomical images.

In this paper, we take visualization as a particular edge and as a topic of study, namely, the interface of images produced by astronomers and images seen by the public in astronomy sessions. Colour washing and other digital enhancements of astronomical images are common practices in the public communication of space science; and is thus a meeting point between the scientific and the aesthetic. This juncture is available within video-recorded data, of astronomy education sessions in various settings and formats (night-sky star parties, observatories, and planetariums).[3]

As we have found in the data from star parties, guides often warn visitors about this disjuncture: not a disjuncture in the Pollner (1975) sense, but between visitors' expectations and what is delivered by the guide. Nevertheless, even though they may have been forewarned by the guide what to expect, visitors express this disjuncture through expressions of disappointment. In trying to accommodate the positions of guides and visitors we align ourselves with positions reflecting the situated, here-and-now lived experience of visitors and the instructional work of guides. In order to achieve this, we conceptualize the social organization of this juncture for visitors in terms of "encountered astronomy" and, for guides, in terms of "managing disappointment". "Disappointment" is a phenomenon for visitors, which some verbalised in the recordings of star parties.[4] The "management" of visitors' disappointment is a known problem for guides and, as we shall see later, is frequently an anticipatory, prospective account for the benefit of those about to look through the eyepiece of the telescope.[5] Rather than taking emotional expressions as a central topic, this paper provides a platform for ongoing investigations that consider these in greater detail.

Elsewhere (Carlin 2017) we have remarked upon Michael Lynch's challenge to the social sciences to align conceptual and empirical topics. Lynch's (1994) comments were based upon the writing of Peter Winch (1958). In endorsing Lynch's deflation of a divide between conceptual and empirical analysis, we provide discussion of what may be regarded as "conceptual issues" that, for the purposes of this paper, have been occasioned by "empirical data". By taking a recurrent worksite contingency, that expressions of disappointment at star parties may be accounted for by the gulf between popular images of astrophotography with what can be viewed through a telescope, we unpack some of Lynch's works for the benefit of astronomy education and communication.

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3 In another project, studies explore aspects of the work of astronomy education and communication in observatories (Carlin et al. 2021a; Marques et al. 2020; Marques et al. 2022); planetariums (Marques et al. 2021); and star parties (Carlin et al. 2021b; Moutinho et al. 2022).

4 As mentioned above, what is recognizable as "disappointment" is not the only reaction expressed by visitors and many of these expressions of emotion are extremely positive (Marques et al. 2023).

5 We owe our noticing of the "prospective" aspect of these "situationally embedded" accounts to the late Aaron Cicourel (1971).

THE PROBLEM OF AUTHENTICITY

A debating point in everyday life, among practitioners of various occupations and academic disciplines, is the notion of *authenticity*. Yet authenticity[6] remains a topic that is recalcitrant to concrete inquiry because of its abstract and inchoate nature. In the Nineteenth Century, authenticity was a concern in the assessment of photographs of fairies and ghosts (Tucker 1997). It is a matter for consideration of a writer's posthumously published work (Mead 1934; Saussure 1959; Wittgenstein 1953) that derives from students' lecture notes. It is one thing collecting an author's papers together into a single volume whilst the author is alive to validate or approve the collection (Blumer 1969; Hughes 1984); however, posthumous editing by others may be at variance with the original authors' intentions (Silva and Vieira 2011; Venturinha 2013).[7] Authenticity is therefore an issue that relates to canons and canon formation (Galison 2003) in terms of the eligibility of corpus items: do lecture notes have the same status as articles in an author's corpus; or, as another example, do particular pieces of music 'count' as 'authentic' blues (Hatch and Watson 1974). What is their "corpus status" (Carlin 2007)?

This questioning attitude toward authenticity is not limited to an academic issue but can have economic consequences. Unfinished work, where 'unfinished' refers to an artist's preparatory or unreleased versions of a finished product, such as a musical score or painting, can become marketable or collectable according to the identity or celebrity of the artist:

> The contemporary cult of authenticity surrounding artworks and interpretations in fact brings about the digging up and circulation of the whole corpus of artwork by the greatest creators, with an ever more inclusive appreciation of sketches and incomplete versions (Menger 2014, 298)

So, preliminary sketches, recordings of studio rehearsals and other fugitive versions of artistic works become marketable products. For example, Jimi Hendrix released three studio albums during his lifetime. His posthumous discography is voluminous, however, where different versions of songs (live versus studio versions, acoustic versus electric versions, sessions versus performances) are regarded as eligible Hendrix works by fans (Roby 2002) and *de facto* have become items within the Hendrix corpus.

Mozart's *Requiem* was unfinished at the time of his death, and much of the famous score is attributed to one of his students, Franz Xaver Süssmayr (Keefe 2015; Wolff 1998). Under these circumstances, what 'counts' as a composition by Mozart? If assessors confirm that a painting found in an attic is indeed an authentic Caravaggio or Picasso, by those who are seen to have the authority to determine authenticity (Becker 1982; McCall 1977), this will make a

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6 When reading the word 'authenticity' read 'authenticity *for whom*'.

7 It was Hughes himself who famously punctured the authenticity of posthumous publication of lecture notes: "Spencer, Comte, Bagehot, and others of the period, wrote in two moods: in one they presented pretentious theories of social evolution; in the other, they commented sharply and sometimes passionately on the affairs of their day. The work of such men is often completely misunderstood because the notebooks used by graduate students contain the pretentious theories, and those only in brief caricature, but not the more timely discussions and the ideas and theories implicit in them" (Hughes 1984, 365).

significant difference to its valuation. The professional expertise involved in such determinations (that a painting is or is not a Caravaggio, for instance) points to the social nature of authenticity: authenticity is not a property of an object but is conferred upon it by an audience.

Since authenticity is considered in various fields, we can point to it as a generic issue. However, there are attendant difficulties with genericness because *authenticity* holds different requirements in different fields. "Authenticity" has slightly different connotations according to the context of its use, e.g. authenticity in photography (Batdorff 2013). It may also be used as a gloss for reference to the presentation of people's versions of events, e.g. in anthropology and in law; and is observable in audience participation during live music performance, in terms of fidelity to the familiar, recorded or "studio" version compared with the in vivo "live" version (Carlin 2024; Carlin and Watson 2025).[8] The common thread between the use of authenticity in description is reference to first principles, of fidelity to the original, and of representation. Following the philosopher Gilbert Ryle, we may say that the "logical geography" of the term overlaps (or shows some similarities) for different fields, but that the terms of its organization are local and specific. In other words, we can say that there is a propositional aspect to authenticity—the authenticity in or of a particular matter, rather than authenticity as an objective quality *per se*.

AUTHENTICITY IN REPRESENTATIONS OF SPACE

Astronomy has a history of change, e.g. from being an astrological to a mathematical science (Dear 2009). Other massive changes in astronomy have been the development of astrophotography in the Nineteenth Century to the availability of digital images, and the achievement of establishing telescopes in space.[9] The Hubble Space Telescope (NASA/ESA) operates mostly in the visible portion of the light spectrum (having also some ultraviolet and infrared light capability). It was the first big optical telescope to be placed in outer space and has been orbiting the Earth since 1990[10], feeding images back to Earth. NASA Image Galleries are populated by photographs taken by Hubble, that have changed the 'landscape' of astronomical images forever:

> From its orbit above our globe, the Hubble Space Telescope has provided a revolutionary view of the cosmos. Freed from the obscuring atmosphere of the earth, the instrument has allowed astronomers to

8 A separate but related problem is highlighted by the striving for authenticity among "cover" bands (Walter, Wildberger and Sormani 2019).

9 The disciplinary changes from diagrams of what could be seen with the naked eye, to meticulous drawings of what could be seen through rudimentary telescopes, to what could be photographed, are detailed in Roy (2018). This disciplinary history of imaging in astronomy provides an interesting contrast with the local, laboratory-specific historicities of renderings (Lynch 2019). https://www.nasa.gov/content/about-the-hubble-story

10 https://www.nasa.gov/content/about-the-hubble-story

> observe with new clarity ... its views of the cosmos have become models for images delivered from other telescopes, including those produced in the service of science at world-class observatories as well as those taken by amateurs with backyard telescopes (Kessler 2012, 4)

Figure 2: Sample of images from Hubble Space Telescope. Credits: NASA, ESA, STScI

Deep-space images from Hubble are now being complemented by images from the James Webb Space Telescope (NASA/ESA/CSA)[11], which was launched in late 2021. Webb, as NASA puts it, is the successor of Hubble[12]. It goes beyond Hubble capabilities, exploring objects at a greater distance and with greater detail, mainly in the infrared portion of the light spectrum.

As part of their work, astronomers make observations but not all "observations" are visualized through an optical telescope (see our discussion of "Contextures of Use", below). Various types of telescopes, tailored to different parts of the spectrum are used by astronomers, e.g. infra-red and radio telescopes, as well as other instruments (Garfinkel et al. 1981). In consequence of the multiplex means of appreciating astronomical phenomena, astronomers are not always working with photographs to which non-astronomers have become accustomed in web browser splash-pages, websites, and popular magazines. However, in a situation when "[astro]photography is the reality: the real object is often experienced as a letdown" (Sontag 1977, 147, our brackets), a telescope on Earth, at a star party or in an observatory, cannot compete with the images taken outside Earth.

A corpus of video-recordings allows us to look closely at the collaborative work of astronomer guides and visitors at events such as star parties and, in this paper, a public observational session. As it turns out, astronomical images and their authenticity as viewed through telescopes is problematized within astronomy education sessions. In our data, astronomer guides seem to be fully aware of the discrepancy between expectations arising from popular images of astronomical phenomena and the more prosaic materials that they ordinarily work with.

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11 It is possible to compare images taken by both Hubble and James Webb telescopes at https://www.webbcompare.com/index.html

12 https://webb.nasa.gov/content/about/comparisonWebbVsHubble.html

ASTRONOMY AND ASTROPHOTOGRAPHY: AUTHENTICITY AND AESTHETICS

There have been many advances in digital imagery and in space science since the publication of a commentary on public and scientific uses of astronomical imagery (Lynch and Edgerton 1988).[13] We regard this commentary as part of a series of papers (Law and Lynch 1988; Lynch 1988, 1991a, 1991b) exploring reflexive ties between scientific artefacts (such as diagrams, graphs and photographs), the textual description of these artefacts, and the different audiences to which these artefacts are presented and purposed.[14] For working astronomers, digital images are created from real data, retrieved from astronomical instruments: "Work of this type, intended for scientific purposes (...) often involved advanced real-time interactions with the data, bright false colour schemes and an abundance of annotations, legends and scales" (Christensen 2007, 83). A digital image is collaboratively worked up orienting not only to its local historicity but also to future uses by other research teams (Hoeppe 2019b). That is, digital images are produced for other astronomers to work on. Regarding astronomical artefacts, such as telescopic images, Lynch and Edgerton (1988) note how some of these are made available for scientific communication—circulated in scientific papers and preprints—and others are edited for the practical purposes of using these in public presentations. As for science communication purposes, Christensen adds that "the challenge is to use the data to convey only the relevant part of the message and keep things as simple and visually appealing as possible. This is often easier said than done and is almost an art form in itself" (Christensen 2007, 83).

The curiosity aroused by images highlights the discrepancy between materials used by professional astronomers and the public interest in space.[15] In part, this relates to the place of telescopic equipment in professional astronomy. Professional astronomers use telescopes differently from members of the public: rather than using telescopes to visualize objects—as per public observation sessions to see astronomical objects and features such as Jupiter's moons (Moutinho et al. 2022), or sunspots (Marques et al. 2020)—professional astronomers use telescopes to generate data and to provide visual confirmation of data from experimental findings produced on other equipment (Hoeppe 2012). For the professional astronomer,

13 Reference to these advances is a reference to a large corpus of astronomical literature. For a brief summary statement, however, see Hannestad (2019).

14 Issues of imaging and representation have been career concerns for Michael Lynch (1985a, 2019). We hope that our study contributes an addendum to the sophistication of his analyses.

15 The designation "professional" astronomer is problematic and highlights an issue for the sociology of occupations. Activities and commitments to astronomy are shared by "amateurs" and "professionals" alike. Even before the rise of what became known as "citizen science" both amateur and professional astronomers contributed to the core of astronomical knowledge. Mass participation in astronomy, such as the classification of objects, creates its own opportunities and problems, which are addressed as distinct from the sociology of occupations (Kasperowski and Hillman 2018).

image work is not confined to telescopes.[16] Furthermore, professional astronomers frequently attempt to *combine* data-sets from a number of different sources (Hoeppe 2014).

In 2017, images produced by "interferometry" were released as the first pictures of a black hole, located at the centre of a galaxy known as Messier 87 (M87).[17] Interferometry is the composition of data from a group of separate telescopes or radio telescopes (an array of telescopes) rather than an individual telescope; a complex reticulation of data overlays (EHT Collaboration 2019a). In effect, many observations taken by multiple telescopes are combined (or "reconstructed") into a single image. The Event Horizon Telescope, which was constituted by radio telescopes located across the world (Doeleman 2019), received data that in reconstruction eventually resolved as a blurry, orange circle—articulated as an "asymmetric ring" (EHT Collaboration 2019b)—very different from the representations of black holes in popular culture. Then, in February 2020, astronomers using the Spectro-Polarimetric High-contrast Exoplanet Research (SPHERE) instrument at the European Southern Observatory Very Large Telescope (VLT) obtained the first direct images of a system of exoplanets—planets outside our Solar System—orbiting around a star (TYC 8998-760-1). This has never been seen before and it is a significant development for astronomy and our view of planetary systems (Bohn et al. 2020).[18]

ASTRONOMY AND ASTROPHOTOGRAPHY: CONTEXTURES OF USE

In his provocative and highly damaging paper "Pictures of Nothing", Lynch (1991b) exposes diagrammatic representations in theoretical sociology which, as he icily observes, possess a peculiarity in that their "intelligibility is unencumbered by any resemblance to things external to the text" (Lynch 1991b, 4). Although, following Lynch and Edgerton (1988), we asserted above that working astronomers concentrate their focus on the data that constitute images rather than the images themselves, we need further clarity on the format of images that astronomers use.

A long exposure, colour enhanced photograph of the Milky Way would be recognizable to an astronomer yet it would contain no "news"—aesthetically pleasing, perhaps, but of little scientific relevance. Yet it would be misleading to say that for astronomers, the products of astrophotography are, *qua* the diagrams contained in social theory texts, "pictures of nothing". For one thing, astrophotography captures images that, whilst of extremely distant objects, are not "explanatory fictions" (Coulter 1979, Chp 6). In that sense alone they are indeed pictures of *something*.

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16 Arguments for citizen science include the distribution of computer processing power across many personal computers (Baudry et al. 2022); and that mass participation affords human rather than AI classification of objects (Kasperowski and Hillman 2018).

17 Some galaxies are referred to as Messier objects after Charles Messier, who compiled a catalogue of drawings of deep-space objects in the eighteenth century.

18 Image available: https://www.popularmechanics.com/space/deep-space/a33391505/exoplanet-orbiting-sun-like-star-image/

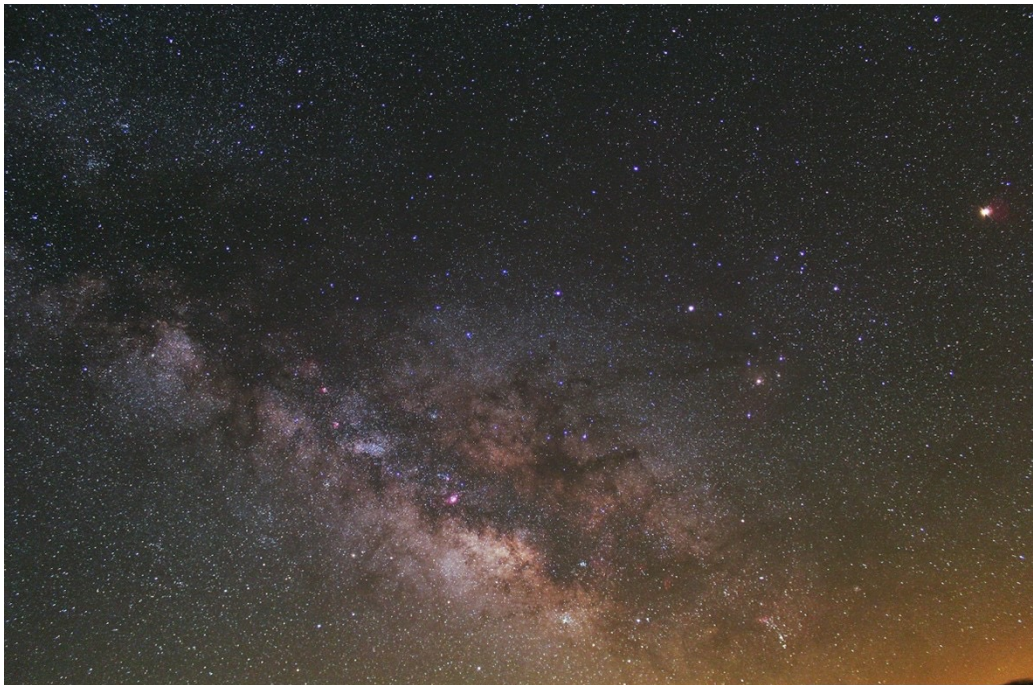

Figure 3: Astrophotograph of the Milky Way, as seen from Portugal. Credits: Cédric Pereira

Yet there is another sense that astrophotographic images are "pictures of something"[19] for working astronomers. Equipmental affordances of different telescope filters and types of telescopes sensitive to different parts of the electromagnetic spectrum—radio waves, microwaves, infrared, visible radiation, ultraviolet, X-rays and gamma-rays—provide astronomers with useful information by enabling them to visualise what cannot be captured by conventional astrophotographs:

> Today many astronomical images are made from data sets that either are outside the optical window or do not match the characteristics of the human eye. Indeed, the role of these images has changed from being a "photograph" to being a representation of the science. They are not intended to show the "true" appearance of the object, at least not as defined by human vision, but rather to illustrate the physical properties of the object (Rector et al. 2007, 598)

Although astronomers work with very large datasets (Hoeppe 2014), much of the observation work comprises signals captured and visualized by spectrometers, which are then mathematically trawled for anomalies or departures from astronomers' models and simulations (Sundberg 2012). The mediation of a spectrometer is crucial when, as said above (Rector et al. 2007), data cannot be "seen" but require manipulation for these to become visually available: "astrophysical data must be studied visually before one can begin to describe it mathematically" (Hannestad 2019, 48). Sometimes there are features that can be "seen" rather than

19 We owe this phrase and the found distinction it describes to Doug Macbeth (personal communication).

"detected" within a stream of data, whichever wavelength is being captured or filters that are applied in the production of an astrophotographic image. For instance, the astronomer Margaret Geller used astrophotographic images as persuasive devices in the paradigm shift in how astronomers conceptualize galaxies (Galison 2002).

Through Lynch's work, we are identifying what Schutz (1970) called a "problem of relevance". The problem of relevance is discerned in different ways according to context, and may be worded differently. For instance, it is exhibited in the discrepant reaction between social and physical scientists at the 'news' that the Soviet Union were the first to test a hydrogen bomb (Sacks and Zipser 1961).[20] The problem of relevance is evident in how visual images are used to conceal, highlight, interpret, and manage information by practitioners in various fields (Bowker 1988; Slack et al. 2007). It is found in Parsons' (1942) exemplification of W.I. Thomas' concept of the definition of the situation, saying that a geographical topology would be quite differently "defined" by a geologist, a farmer and a military officer interested in safeguarding that land from military attack.[21] Whilst Lynch and Edgerton (1988) identify the popularization function of pretty pictures, beyond science communication the relevance of these to working astronomers was negligible. With advances in digital technology, there is a dual use whereby such pictures obtain both an astronomy outreach/communication potential and reveal hitherto unnoticed phenomena for future investigation, i.e. a *prospective* relevance.

SPECIFYING GESTALT-CONTEXTURES IN SETTINGS FOR ASTRONOMY COMMUNICATION AND EDUCATION

Through close attention to the membership work of astronomy education, i.e. examining what might be called the "infrastructure" of astronomy education using an ethnomethodological approach to astronomy education in action, we have arrived at what we tendentiously call "encountered astronomy". Some of the bases for this praxiological and conceptual development for science communication, which we shall unpack further in the next section, are located in Lynch's work—specifically, in his advancements of Garfinkel's use of "Gestalt-contexture" analysis for ethnomethodology. A first literature problem in suggesting this is chronological: how can we present Lynch's considerations of Gestalt-contextures as an advance on Garfinkel's statements, what he had reformulated as "a figuration of details" (Garfinkel 2002, 167), if Lynch's accounts were published beforehand? This anachronism reflects the published availability of Garfinkel's writings, which informed the work of his students over time. The second literature problem was emphasized by Garfinkel: what he had made of Gurwitsch's twist on a psychological concept was specifically unavailable from Gurwitsch's own work, yet

20 With thanks to Alex Dennis for bringing this Sacksian ephemera to our attention.

21 If any reader finds Parsons' example evocative, elsewhere (Carlin et al. 2021a) we used Lynch's (2018) work in the specification of "professional vision" (Goodwin 1994) which, as a formal concept, has been stretched beyond its usefulness. For contemporary ethnomethodology, "professional vision" seems too general and underdefined to account for worksite details.

it was specifically informed by his reading of Gurwitsch's work. Returning to Gurwitsch—as "literature review sociology"—misses Garfinkel's point.

As we have mentioned, the data for astronomy derive from multiple sources and are amenable to analysis using multiple instruments. Our data for *this* study are readings of the achievements of astronomy and astronomy education, of ethnomethodology, and our viewings of video-recordings of sky observation sessions. For us, the significance of the interactional problem—the gulf between what can be seen and experienced by the visitor through the telescope and the achieved images of astrophotography—is how, *multum in parvo*, the ramified sources of the public communication of astronomy converge. Indeed, guides' accounts are necessarily adumbrated and attenuated; within public observation sessions, guides are only able to gloss partial slices of extensive, intricate research. This body of astronomical knowledge and research, to which guides allude, encompasses astronomical distance, planetary rotation, and time (Marques et al. 2021); and these conceptual distinctions, on such phenomenal scales, are elaborative explananda for guides within observation sessions—contingent upon the participation of visitors.

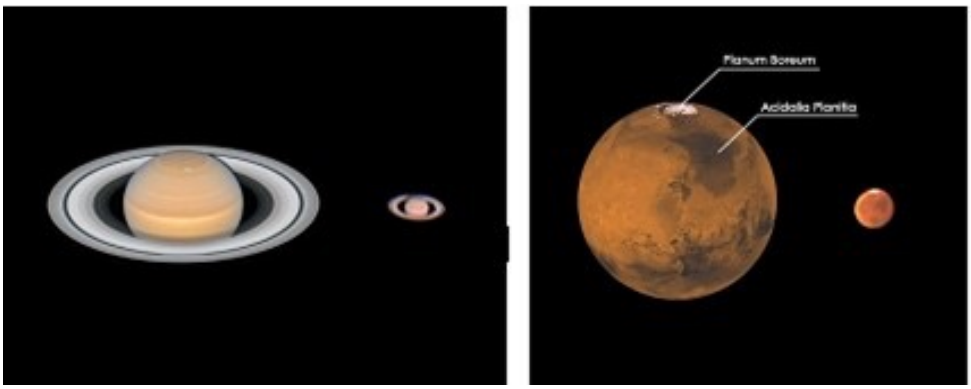

Figure 4: Comparison between NASA photos (left of each image) and amateur astronomer photos (right of each image), of Saturn and Mars. Credits: Cédric Pereira and NASA

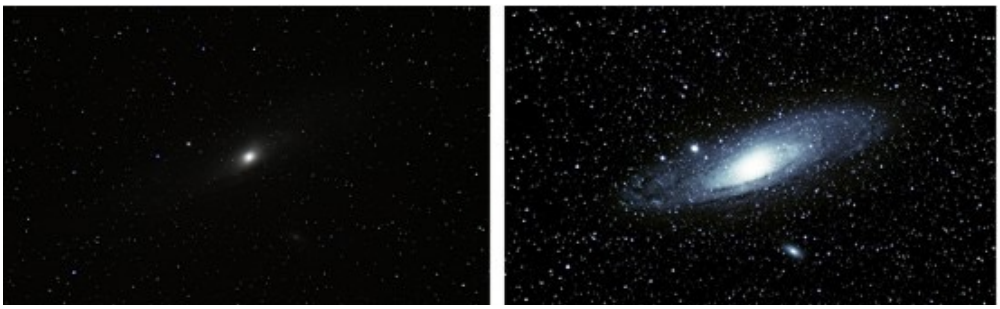

Figure 5: Galaxy of Andromeda as seen through the telescope eyepiece (left image) and in an astrophotograph, with long-exposure (right image) Credits: Cédric Pereira

Throughout this paper we have noted a variety of "categorial incumbencies". The complex that is professional astronomers and amateur astronomers is permeable; likewise, the occasioned for-all-practical-purposes categorizations within astronomy sessions, of astronomer guides and visitors. However, we desist from traducing categorially arranged settings into "duplicatively organized" categories. Categorial arrangements are important but these constitute only part of sky observation settings. It is from the close analysis of members' practices that are identifiable within our data that we can suggest members (astronomers and visitors) engage within seamless activities as "Gestalt-contextures" (Gurwitsch 2010). It is through the empirical investigation of how sky observation sessions are organized in situ that we realize the usefulness of Garfinkel's respecification of Gurwitsch's respecification:

> Gurwitsch's respecified generics of gestalt theory and principles consisted of generics based on line drawings and lecture and laboratory demonstrations. But the problem of the coherence of objects takes place at the work site and is endogenous. It was to meet this constraint that local, endogenously produced, witnessably observed phenomenal fields of ordered phenomenal details are empirically specified in any actual case (Garfinkel 2002, 73)

Our engagement with the data—the contexts that members produced *within* the observation sessions—encouraged us to take seriously Gestalt-contexture analysis "to empirically specify, and workplace-wise to learn, design, recognize, teach, administer, etc., what adequate methods and evidence could be in descriptions of the congregational production and accountability of social order" (Garfinkel 2002, 258). For us, the attempts to investigate sky observation sessions underscore the reflexivity of data and analysis. The move to empirical specification, as advocated by Garfinkel, was informed by Lynch's considerations of Gestalt-contexture analysis in relation to laboratory-specific details.

Lynch elaborated upon Gurwitsch's phenomenological twist to what had originally been a psychological concept by using the coinage "topical contextures" (Lynch 1991c). According to Lynch, "The *topic* of laboratory space is not primarily concerned with the "naming" or "labelling" of space but with the grammars of spatial concepts associated with particular practices" (Lynch 1991c, 53, emphasis in original). Whilst Lynch is observing laboratories and activities within laboratories, his explications of the scenes he is studying set up the description of a very different context—an observation of the sky.[22] For what we saw at the observation sessions under study, both first-hand and preserved on video, was a 'general public' (who we gloss as 'visitors'), an astronomer guide (sometimes accompanied by other guides), a telescope (again, sometimes more than one)[23] and, importantly, the sky.

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22 Within this context of an observation of the sky there are further contexts (or "topical contextures"), which are categorially and sequentially organized.

23 In some of the sessions that we recorded there was also a projection showing an image of what was in view through the telescope.

Although the notion of Gestalt-contextures featured rarely within ethnomethodology[24] until Lynch's observations, one of Lynch's many contributions to ethnomethodology was in specifying Gestalt-contextures of local, worksite specifics:

> It would be incorrect to say that any particular application of language *creates* a space of operations; rather, any such application participates in a contexture of activities in which space is organized (Lynch 1991c, 53, emphasis in original)

Consideration of Gestalt-contextures embarrasses partial analyses; yet, Lynch's subtle shift (from contexture to *topical contexture*) is missed by practitioners of the studies of work programme, such that workplace studies are vulnerable to a critique of replicating previous studies from different settings (Button, Lynch and Sharrock 2022). The increasing visibility of Gestalt-contexture analysis disguises Lynch's contributions on this matter.

Whilst reiterating the caveat that Lynch's research sites are laboratories not astronomical settings, e.g. observatories, planetariums or observation sites, the elaboration of topical contextures provides analytic affinities between local ecologies:

> perceptual space is organized by topical contextures—local orderings of referential details exhibiting visible relations of above/below, next to/separate from, inside/outside, before/behind, aligned with/askew, and so on. These spatial predicates are topically bound to particular constellations of details rather to an invariant spatial matrix (Lynch 1991c, 53)

Even though members (users of natural language, including astronomers and non-astronomers) are subject to the exigencies of a pre-ordered sky, which contains arrangements of objects that have already been named and classified, the non-astronomers attending star parties encounter a what we may provisionally call a "depth" of information. We use the gloss "depth of information" to indicate that non-astronomers become aware, quickly, that the information provided to them by the astronomer guide for the practical purposes of participating in the observation of the sky is a narrow slice of the information that the astronomer guide could, in different circumstances, share with them. The "business" of the observation of the sky is to allow members of the general public access to some means of observing what otherwise could only be approached with basic equipment or with the naked eye: observations of the sky afford the curious with opportunities to look at the night sky using powerful (in an amateur and educational context) telescopes.

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24 Although mentioned in unpublished manuscripts, we do not find much of Gurwitsch's concept in Garfinkel's published work prior to Lynch highlighting its importance. Larry Wieder was perhaps the most extensive and consistent advocate of Gestalt-contexture analysis (e.g. Wieder 1974), though much of his writing on Gurwitsch's notion remains unpublished.

Figure 6 Telescope used to observe Ceres, from the Geophysical and Astronomical Observatory of the University of Coimbra (OGAUC). Credits: OGAUC

As such, these observation sessions are equipmentally organized, i.e. observations are conducted using purpose-built instruments that provide for communicating the achievements of astronomy to the public. This is a crucial point for the study of science communication, which is captured by Edward Rose's distinction between "the business at hand" and "the something-else-again" (Steffens 1990). Taking material or equipmental specifics, such as how to address the eyepiece of a telescope in a way that allows the visitor to look at a magnified object in space, allows us to discuss how science is communicated (the business at hand). Yet there is another context—the something-else-again:

> The process of working with such materials cannot adequately be characterized by focusing only on verbal references to an object, literary inscriptions, the relationship between written accounts and visible displays, or embodied actions at the lab bench (Lynch 1985b, 38)

Any attempt to account for all of the features of use that constitute the Gestalt-contexture of an observation session within a single description would be lacking. These would feature the spatial configuration of people apropos the telescope; the direction and focus of the telescope; looking through a telescope; recognizing an object of attention using the telescope; neophyte status, i.e. not being in command of a corpus of (astronomical) knowledge; amateur status, i.e. having a command of some[25] astronomical knowledge; the guide's instructions; visitors' comprehension of the guide's instructions ... et cetera. Crucially, however, even such a ten-

25 Where "some" is non-specific and could be considerable. This returns us to the permeable amateur/professional categories, which are not mutually exclusive. See note 15.

tative enumeration of relevant features that constitute an observation session neglects the omnipresent context of the night sky, as a vista. This contexture is further contextualized by people themselves looking at the arrangements of objects as constellations recognizable within this vista; and candidate objects of attention for this particular observation within this vista. As the largest, most complicated research site of all—the visible Universe—we characterize the accounting for all of the relevances within this Gestalt-contexture as "encountered astronomy".

ENCOUNTERED ASTRONOMY

Traducing a notion from analysis of discovering sciences, *viz.* "encountered maths" (Sharrock and Anderson 2011, 48), what we find in astronomy education and communication sessions is "encountered astronomy". *Encountered astronomy* glosses the information that an astronomer guide presents to a cohort of visitors, which is of course not the entire plenum of astronomical knowledge, plus the lived experience of looking through the telescope. *Encountered astronomy*—looking at an object through a telescope and the astronomer's account—does not and cannot replicate the experience of looking at an object as realized through astrophotography.

When we inspect video-recordings of guided tours of observatories (Carlin et al. 2021c) we see that guides frequently engage in accounting work. Taking one observation session[26] as a single case, at which one of the objects viewed was the dwarf planet/asteroid Ceres, we see a recurrent organization in accounting work produced by guides. First, to anticipate members' expectations of what can be seen through a telescope; second, guides provide an account to manage disappointment at the quality of the image.

Figure 7 Ceres in Colour. Credits: NASA.[27]

26 This observation session was timed to coincide with the UN's annual Asteroid Day (https://AsteroidDay.org).

27 https://science.nasa.gov/resource/ceres-in-color/

The following two extracts are transcripts of recorded talk from the same observation session on Asteroid Day.[28] Ceres is visible in the sky with a telescope. In the first extract the guide starts by describing that what can be seen through the telescope is just a tiny point, a dot; and explaining why it looks so small.

```
Extract 1
1.  G  vão ver uma coisa muito pequenina
       you will see something very small
2.     que vão achar que é uma estrela
       that you will think is a star
3.     (.) mas que não é
       (.) but that is not
4.  Ps ((risos))
       ((laughs))
5.  G  que é na verdade o asteroide Ceres
       which is actually the asteroid Ceres
6.     o maior de todos que tem 1000 kilometers de diâmetro
       the largest of all that is 1000 kilometres in diameter
7.  P  ((suspiro de espanto))
       ((sigh of amazement))
8.  G  mas que está a mais de três vezes a distância da Terra ao Sol
       but is more than three times the distance from Earth to the Sun
9.     e a gente só recebe o brilho que ele reflete do Sol
       and we only get the light that it reflects from the Sun
```

In the second extract, the guide anticipates that seeing Ceres through the telescope "is not exciting at all" (line 6), and then explains that images of Ceres that the visitors may see on the television news are quite different from the image of Ceres that they are able to see through the telescope. From lines 9 to 13 the guide formulates this huge distinction (and the reason for that difference) between what can be seen with a small telescope on Earth and what can be seen by a space probe travelling near the Asteroid.

```
Extract 2
1.  G  Em[bora
       despite
2.  P1   [eu não vi bem  ((não parece ser dirigido ao guia))
          I didn't see well ((not directed to the guide))
3.  G  nós saibamos que ver um asteróide
       us knowing that seeing an asteroid
```

28 In Portuguese with English translation. G = Guide. P = Unidentified Member of the Public. Ps = Members of the Public speaking in unison. P1, P2 = identifiable Members of the Public.

4. *num [telescópio deste tamanho*
   with a telescope this size
5. P1 *[não se consegue ver nada ((não parece ser dirigido ao guia))*
   nothing can be seen ((not directed to the guide))
6. G *não é nada entusiasmante*
   is not exciting at all
7. Ps *((risos))*
   ((laughs))
8. G *porque (.)*
   because (.)
9. *as imagens dos asteroides que nós vemos nas-na televisão*
   the images of asteroids that we see on the the television
10. *são sempre tiradas (.) por sondas espaciais (.) que passaram lá perto*
    are always taken (.) by spacecraft (.) that go nearby
11. P2 *pois (...)*
    yes (...)
12. G *e mesmo assim: aquilo é assim umas umas rochas tipo batata*
    and even that way that is like some some rocks like a potato
13. *né? com várias crateras e tal*
    isn't it? with several craters and so

The newsworthiness or "tellability" (Sacks 1992) of Ceres provides an occasionality to this particular asteroid. Ceres had been in the news because there had been reports that one of the asteroids from the same 'belt' could collide with Earth. Whilst astronomy education and communication events may be organized by astronomers according to ephemerides, i.e. sessions are delivered to coincide with astronomical events, some topics of talk within sessions are public driven rather than astronomer driven—according to current news stories or personal curiosity. Such topics are outside the standard content of sessions; however, as "peripheral" content, they may be incorporated into future discussions as timely examples with which visitors may be familiar (Gilbert 1976).

CONCLUSION

Within "encountered astronomy", aesthetics and authenticity are not abstract, theoretical matters but are interactionally available, in the concrete. We suggest that the notions of encountered astronomy, aesthetics and authenticity are important considerations for the public communication of science. As it turns out, astronomical images and their authenticity as viewed through telescopes is problematized within astronomy education and communication sessions. In our data, astronomer guides seem to be fully aware of the discrepancy between expectations arising from popular images of astronomical phenomena and the more prosaic materials that they ordinarily work with.

As Lynch shows, the distinction—sometimes *sotto voce*, sometimes more explicit—between aesthetic considerations and scientific considerations, i.e. how to present data for dif-fe-

rent audiences, is not trivial. Indeed, for various contexts, e.g. in astronomy and astrophotography (Lynch and Edgerton 1988) and nanotechnology (Lynch 2019) and, in this paper, astronomy education and communication, the distinction revolves around important issues to do with teaching and learning (textbooks, etc.) and outreach. For, the simplification of data presentation (in nanotechnology) and the enhancements of astrophotographic materials (in astronomy) are crucial in the communication of science.

Furthermore, in the case of space-based astrophotography, certain images have provided astronomers with unexpected details for further exploration and analysis, and have assisted in the reconceptualization of how aspects of the Universe work. What may be regarded as an aesthetic/scientific distinction is more complex, as "aesthetic" images can feed scientific curiosity, cause re-evaluation of existing knowledge, or provide opportunities to answer puzzles. That is, the distinction is not just non-trivial but, as demonstrated in other settings also, it is *a matter for members themselves*, i.e. practitioners, not limited to analysts:

> rather than being a theoretical or methodological problem for researchers, the issues of what constitutes an artwork and how this is achieved are dealt with by members of the art world themselves, practically and in situ, during the course of their carrying out ordinary activities in relation to a particular work of art (Kreplak 2019, 143)

From repeated viewings of videos and first-hand experience of operating telescopes in educational and science communication contexts, what looks to be a straightforward activity—looking through a telescope in order to visualise the object of attention—requires work, practice and patience (Marques and Retrê 2023). One of the unfortunate aspects of observations of the sky for visitors is if they are unable to see through the telescope then their experience of the astronomy session will be diminished. For guides, another known but pressing problem is the ubiquity of images of space. Part of the guide's work is to manage the expectations of visitors who anticipate that what will be seen through the eyepiece of the telescope will be fully magnified, well defined, and extremely colourful. However, these are not the images the human eye can see when looking through a small educational telescope or even an amateur astronomer one. The definition and magnification are not comparable, digital photographs are often composites of a number of photographs, treated with filters and adjustments to contrast settings, and the human eye does not afford the long exposures that are necessary for astrophotography.

Dealing with visitors' expectations is exacerbated by advances in space research: even state of the art telescopes can hardly compete with the images captured by space-based telescopes in orbit, or on space probes that have traversed through the Solar System, which have photographed planets, moons and asteroids at a closer proximity. In many cases, experienced guides know people are often expecting better images when they look through the eyepiece, and they account for the discrepancies between what is seen during the session and the images available elsewhere to manage and minimize visitors' disappointment. Within the management of ex-

pectations, guides formulate what is being viewed as "authentic" astronomy as a contrast set with the "aesthetic" images produced by astrophotography.

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