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Science Storytelling beyond the Dramatic Arc: Narrativity and Little Red Schoolhouse Principles in Science Communication

Daniel Aureliano Newman

Abstract: *Narrative is widely recommended for improving science communication, yet the main approach to science storytelling is limited and limiting, advocating fixed dramatic arcs and the ideal of narrativehood, the absolute quality of being a coherent narrative. Neglected by this approach, I argue, are the finer grained linguistic patterns that give texts local narrativity, the quality of being narrative in a scalar, adjectival sense. I harmonize narrativity with the well-established principles of clear technical writing developed by Joseph Williams, then demonstrate how these principles might be used and taught through a comparative reading of several texts discussing a single topic in genres ranging from amateur blogs to specialized scientific journals. The narrativity-based approach has several advantages. It avoids the reductionism of the template-based approach, as well as its questionable dependence on narrative structures derived from the arts and entertainment. In terms of adoption by scientists and other science communicators, the approach also has the advantage of not requiring a radical overhaul of current communicative practices; it also reduces the difference between technical and public-facing writing. In short, the approach proposed here offers a workable and effective way to telling science stories with minimal simplification or distortion of scientific information.*

Introduction

Science communicators of all stripes have become increasingly interested in the promise of narrative (e.g. Joubert et al.), yet they are anything but united in their view of what narrative is exactly, let alone how it should be used. Some scientists dispute the promise of storytelling (Katz), and even those who are more receptive admit "there is much more we have to learn about how we as scientists can incorporate storytelling into our professional lives as we strive to make science more understandable, more inclusive, and ultimately, more beneficial to the world" (Suzuki et al. 9470). By contrast, a small but influential group of authors suggest, sometimes outright, that we already know all we need about storytelling. These science-story popularizers tend to downplay or dismiss concerns that narrative can oversimplify, distort, or misrepresent complex scientific information (Blanton and Ikizer; Winterbottom et al.). Storytelling may well be part of the answer to the problems facing science communication, but it is certainly not, as Rafael Luna puts it, "the simple answer" (7).

For the science-story popularizers, simplicity is the whole point, and many of their views rely on a concept known as *narrativehood*. Narrative, in their view, is a simple dramatic arc, typically a version of Freytag's Pyramid (Angler; ElShafie; Luna; Olson), Joseph Campbell's monomyth (Angler; ElShafie; Olson), or the Hegelian Dialectic

(Angler; Olson). "Every story," argues Randy Olson, "can be reduced to this simple structure" (16): it is a "template" (Olson 9) or a "formula" (Angler 105) whose use is straightforward and appeal universal. Its vaunted simplicity is exactly what worries sceptics. Retelling "the same story" (Olson 34) is a dubious strategy given that science so often describes processes and phenomena that defy our cognitive frames and representative conventions. This is not to suggest abandoning science storytelling, but its risks and limitations require more consideration from popularizers. If the challenge is to harness the power of narrative without compromising the science (Dahlstrom and Scheufele), we must expand working definitions of narrative beyond the doubtful simplicity of templates.

Here, I offer a modest step toward such a goal. It is a small, practical part of a larger project aiming to strengthen science communication with insights and methods from narrative theory (narratology), a field largely unacknowledged in discussions of science storytelling. I begin by proposing an alternative to the structural definition of narrative currently favored by science-story popularizers, in which narrative equates with *narrativehood*, a "binary predicate" (Herman 90)—a text in this context either is or is not *a* narrative. Narrativehood is in my view a counterproductively reductive target, excluding a wide range of potentially helpful narrative features. A more promising quality is *narrativity*, "a scalar predicate" that admits varying degrees of narrative (Herman 91). Whereas narrativehood refers to a text's global structure, narrativity encompasses more granular local dynamics that are crucial to making complex scientific information intelligible and interesting. In Part Two of the essay, I outline principles for identifying and boosting narrativity, based on the Little Red Schoolhouse (LRS) writing program developed by Joseph Williams. Finally, to help put these principles into teaching and communication practice, I compare narrativity in various accounts of the same biological phenomenon in texts ranging from amateur-science blogs to technical articles. The comparison illustrates how LRS principles reflect narrativity and model a flexible, nuanced, and responsible approach to science storytelling.

Narrativity beyond Story Templates

As evidenced by the acclaim of a fictional work like Rachel Cusk's complex, plotless fiction, *The Outline Trilogy*, stories need not be simple, dramatic, or globally coherent to be compelling. So let's look beyond the intuitive appeal of the dramatic arc to a more rigorous and more expansive theory of narrative. Good storytelling may not *need* theory, but a workable and responsible framework for science storytelling probably does. Theory can jolt us out of conceptual ruts and calcified practices, and indeed narratological research hints at how much we can still learn about the role and diversity of narrative practices in science.[1] In the meantime, however, we need a theory of narrative that is both practical and consistent with existing communicative practices in science.

There is no need to reinvent the communicative wheel, thankfully, because narrative is already inherent in scientific descriptions of phenomena, in models, and in data repre-

1. See, for example, work on narrative and science in philosophy (e.g., Rosales), literary studies (e.g., Scherr), psychology (e.g., Dahlstrom) and pedagogy (e.g., Corni et al.).

sentations. "Science has stories in it," writes Nobel chemist Roald Hoffmann (253), who finds scientific articles and lectures packed with "narrative devices…, employed both spontaneously and purposefully" (250). Attending to narrative *devices*, as opposed to narrative *structures*, sounds promising. It would also move us past the notion of story as a mere vessel for scientific content. An effective program for science storytelling should focus more on how "story elements" produce narrativity, and perhaps less on how "plot elements" give form to whole narratives (White 20). Also promising is Hoffman's recognition that scientific texts have their own narrativity, if only here and there; it counters the assumption, common among popularizers, that narrative is foreign to science, in need of importation from the Humanities (Luna 7) or Hollywood (ElShafie; Olson). Overall, when our view of story shifts away from coherent plots and fixed structures toward a mode of argumentation, the distance between narrative and scientific thinking narrows considerably.

If narrative is a logic for stringing together propositions, science storytelling should attend more to local scales of discourse. While some science-story popularizers do consider sentences and paragraphs, they generally treat these structures as microcosms of the global (Olson 73–4; Schimel 95–6), thus retaining the primary framework of narrativehood. Meanwhile many texts "are full of narratives and micro-narratives, yet many would hesitate to call the works as a whole narrative" (Abbott 14). It is indeed at "causal locations" within and between sentences that readers are most influenced by stories (Dahlstrom 857), the sentence level being "where meaning is created" (Junker 251). A shift in focus from plot elements to local narrative elements that contribute little to overall structure would, however, productively expand what counts as science storytelling.

If we treat science writing as a *weave of narrative elements*, we might productively shift our focus on storytelling from narrativehood to narrativity, from plotting to narrating.[2] This shift would not require a deep dive into narrative theory, or even a major change in writing approach. A very basic engagement with narratology should suffice to help link narrative principles to familiar stylistic approaches to effective writing. Science communication and scientific writing cannot and likely will not adopt radical overhauls of current practice. Academic fields are resistant to changes in practice, and most scientists I have worked with prefer practical over theoretical approaches to better writing. Instead of reinventing the wheel, we might exploit the tools already available to those concerned, as teachers or practitioners, with science communication.

Narrativity as Clarity

A promising way to proceed lies in the principles associated with the University of Chicago's "Little Red Schoolhouse" (LRS) writing and pedagogy program. Developed in 1980 by Joseph Williams and Gregory Colomb, LRS teaches "an approach to writing

2. Tellingly, a local focus is characteristic of studies measuring the impact of narrative on citation rates and other metrics of communicative success. Doing so would not require a deep dive into narrative theory. Such studies use "indicators of narrativity" at the sentence and paragraph level (Hillier et al. 3–4) or "measures of writing style" of which "narrative structure" is a key criterion (Freeling et al. 342).

that considers the particular challenges of writing about complex, expert subject matter for a variety of readerships" ("Who we are"). Crucially, the approach is framed in narrative terms, though this feature has enjoyed scant attention from narratologists; even writing scholars and teachers often treat it as incidental or metaphorical, rather than essential to the method.

Storytelling emerged as the core of Williams's writing pedagogy in direct response to the inaccessibility of scientific writing. It was while teaching clear writing to medical scientists that he "discovered…the importance of story" (Williams, qtd in Gee). The result was the LSR program and his book *Style: Toward Clarity and Grace* (1981), an early section of which is duly entitled "Telling Stories" (19). But these stories are not the dramatic plots of the science-story popularizers; such a feature, Williams suggests, is unnecessary in documents concerned primarily with "explanation" (20). Williams would seem to see narrative much as Hayden White does, "less as a form of representation than as a manner of speaking about events" (White 2). This account, which dissolves the intuitive opposition between narrative and exposition, offers a granular and malleable model of storytelling. Because it is already established, its use demands no major overhaul in approaches to science writing.

Williams's approach is simple, pairing two grammatical categories with two narratological concepts: subjects with characters and verbs with actions. Recognizable, consistent and tangible characters and tangible actions generate narrativity, so that "even prose that may seem wholly discursive and abstract," writes Williams, "usually has behind it *the two central components of a story—characters and their actions*" (20, my emphasis). Clear writing foregrounds these components, especially when the subject-characters and action-verbs are arranged into interconnected stretches of continuous discourse

> at the beginning of a series of sentences, creat[ing] for your reader a reasonably consistent point of view, a consistent topic string. When that consistent topic string consists of your cast of characters as subjects, and you immediately connect those subjects with verbs that express the crucial actions, you are a long way toward writing prose that your readers will perceive as clear, direct, and cohesive. (Williams 52–3)

This is storytelling, if not telling *a* story. Topic strings produce continuity across sentences, creating a narrative or narrative-like sequence. The link between Williams's syntactic-stylistic approach and narrative is more than metaphorical: its focus on characters and actions over stretches of continuous discourse is easy to assimilate, for example, with philosophical perspectives on causality in science and narrative (e.g. Junker 251).

The syntactic patterns targeted by LRS principles are readily visible in effective science writing for non-experts. Consider a *New York Times* article by immunologists Akiko Iwasaki and Ruslan Medzhitov, published in mid-2020 when a Covid-19 vaccine still seemed fanciful. As an attempt to educate and reassure the public about a confusing and politicized health crisis, the article is science communication at its most high stakes. It is not a story, but it has a high degree of narrativity thanks to its careful management of subject-characters and verb-actions. Witness the following passage, in which I bold subjects, capitalized their verbs (actions) and, because they occasionally differ from subjects, underline characters:

> Virtually **<u>all viruses</u>** **that** INFECT humans CONTAIN in their genomes blueprints for producing <u>proteins</u> **that** HELP <u>them</u> evade detection by the innate immune system. For example, **<u>SARS-CoV-2</u>** APPEARS to have a gene dedicated to silencing the innate immune system. Among <u>the viruses</u> **that** HAVE BECOME endemic in humans, **<u>some</u>** HAVE also FIGURED OUT ways to dodge the adaptive immune system: **<u>H.I.V.-1</u>** MUTATES rapidly; **<u>herpes viruses</u>** DEPLOY <u>proteins</u> **that** CAN TRAP and INCAPACITATE antibodies. (Iwasaki and Medzhitov 2020)

These sentences consistently favor subjects that are easily graspable as characters: while hardly anthropomorphic, viruses are discrete entities that can be conceived as agents. Such clause- and sentence-level patterns are crucial for narrativity, though not sufficient. Narrativity cannot be *too* local and requires some degree of continuity (Sturgess 8). Note, then, the topical continuity linking the sentences above, whose subject-characters are mostly viruses. Such "[c]onsistency of protagonists" is essential to both narrativity (Fludernik 158) and cohesive prose (Williams 52). The pattern Williams calls "topic strings" is effectively the creation and maintenance of character over stretches of discourse: by populating the beginning of successive sentences with "a limited set of referents," topic strings produce what "readers will take the main characters of the story" (82) to be. Of course, narrativity can accommodate more than one character (Williams 82). In the passage surrounding the sentences quoted above, Iwasaki and Mdezhitoz do not always feature viruses. Some of their sentences have less clearly agential subject-characters:

> The **<u>immunity</u>** created by vaccines DIFFERS…
>
> **<u>Vaccines</u>** COME in different flavors…

While not viruses, immunity and vaccines are thematically and biologically part of the same general story of infection, immunity, and vaccination. In short, the clarity and narrativity of Iwasaki and Medzhitov's article emerge from just a few related patterns at the level of clauses, sentences, and paragraphs.

The *Times* article's reach and reception are undeniably inflected by the authors' status as Harvard experts and its publication in a "liberal-elite" newspaper. But the syntactic patterns that give the article narrativity are transferable, able to serve in any number of forums and mediums, from children's books and school materials to science blogs and peer-reviewed journals, from TV news to the Covid-19 update emails I receive from my city councillor. This fact provides the basis for teaching science communicators about narrativity and how to incorporate it in science stories.

Comparing Narrativity across Science-writing Genres

As a quality of clear writing, narrativity varies predictably across science writing genres, from the entertaining to the most informational. The variation should be detectable in the choice and consistency of a text's main characters and actions. Less specialized texts likely feature a smaller cast of characters that tend toward concrete agential entities like scientists or caribou, or dynamic things like atoms or clouds. Narrativity also varies within genres, depending on authorial idiosyncrasies, editorial practices, and other contextual factors. In any case, the existence of such scalar variation suggests a comparative approach for teaching science communicators how to recognize and generate narrativity, whether across drafts of one document or simply different documents. Juxtaposing different texts with similar content helps highlight modulations in narrativity across communicative situations rather than reducing narrative to a present/absent binary. The comparisons that follow might thus inspire practical exercises and/or assignments for students aiming to improve their academic writing or become science communicators.

In its simplest form, the approach involves contrasting two versions of one sentence. It is much easier to see what gives incipient narrativity to a sentence from Iwasaki and Medzhitov's article, for example, if it is juxtaposed with a revision (my own) that rearranges its elements in ways that obscure character and action:

> Thankfully, <u>**SARS-CoV-2**</u> DOES NOT SEEM TO HAVE EVOLVED any such tricks yet. (Iwasaki and Medzhitov)
>
> Thankfully, the <u>**evolution of such tricks**</u> HAS NOT yet OCCURRED in the case of SARS-CoV-2.

My revision replaces the original's concrete character (a virus) with a complex abstraction (the evolution of tricks), and the kinetic, specific verb (evolve) with a static, general one (occur). My revision is not a bad sentence, but the original is clearer both on its own and in its larger textual environment, as part of a topic string spanning several sentences.

We can also compare narrativity across genres. In what follows, I model how such comparisons serve to concretize the abstract notion of narrativity and to illustrate the related LRS principles. As a case study, I chose the topic of coevolutionary arms races, first hypothesized by Darwin to explain why some pollinators have very long proboscides (tongues) and the plants they visit have very deep corolla tubes. The topic lends itself to the concerns of science storytelling: the science is complex, defying simple storification. Like anything Darwinian, it is also polarizing. Finally, it has broad appeal, as attested by its recurrent discussions in popular-science magazines (*National Geographic*), newspapers (*The Guardian*), and blogs (Laidback Gardener). The topic's manifestations across genres reveal similarities and differences in narrativity and form the basis for lessons on understanding, teaching, and practicing the art of science storytelling.

Let's begin with an accessible, high-narrativity account that also satisfies the popular notion of story as a dramatic arc. This excerpt, bearing the same typographical markers as above, is from Angel Eduardo's "The Orchid and the Moth: Why Scientists Are the True Prophets," published by the science-advocacy Center for Inquiry:

> In 1862, <u>**Charles Darwin**</u> RECEIVED a sample of orchids from Madagascar. Among them, <u>**he**</u> NOTICED, WAS **a flower with an unusually long nectary**, the orchid's nectar-producing gland. At nearly a foot in length, <u>**this**</u> WOULD KEEP the nectar from any known insect looking to partake. <u>**It**</u> GOT Darwin wondering.

> Days later, **Darwin** MADE a prediction: In Madagascar, there MUST BE **moths** with tongues long enough to feed on that flower. Through his knowledge of evolution and ecology, **he** KNEW that **the orchid and this moth** MUST HAVE CO-EVOLVED—but **no one** HAD ever SEEN the moth.
>
> Twenty years after Darwin's death, **the moth** WAS DISCOVERED.

This passage, because it has both high narrativity and narrativehood, offers an account of Darwin as problem-solver that conforms to the dramatic arc of rising tension and resolution advocated by most science-story popularizers. The structure is typical of amateur or outreach accounts of moth-orchid coevolution. Effective as it is for such purposes, it demands a tight focus on the researcher as hero, often at the expense of complex scientific explanation. A dramatic arc may be appropriate in some communicative contexts, but limiting in others.

Such situations would call for relaxing the pursuit of narrativehood and focusing instead on boosting local narrativity. Consider how Ed Yong, author of *National Geographic*'s "Not Exactly Rocket Science" blog, embeds an accessible yet finer-grained explanation in his account:

> [**Darwin**] SUGGESTED that **the two species** WERE LOCKED in an 'evolutionary arms race'. **Orchids and pollinators** gradually CO-EVOLVED over time, lengthening both tongues and spurs in response to each other. **Orchids with the longest spurs** HAVE an advantage. **Their nectar stores** ARE only just within reach of pollinators, so **they** ARE tempting but DON'T SACRIFICE too much valuable nectar. For pollinators, **the advantage** BELONGS to those with the longest tongues because **they** HAVE access to the most food.

Initially foregrounding Darwin, Yong rapidly shifts to orchids and pollinators, placing them at the head of most clauses and thus creating fairly consistent topic strings. Though he finally returns to Darwin, the scientist-as-detective narrative is more diffuse than Eduardo's, the focus shifting for relatively long stretches of discourse to micro-narratives whose characters are orchids, moths, or parts of their anatomy. This is not to say one approach is better; each has its purpose and audience, and each narrates accordingly. What parallel readings uncover is how science communicators range up and down the ladder of narrativity, by negotiating three related variables: subject-characters, verbs, and sentence topics.

Parallel readings can also bridge the perceived divide between "popular" and "professional" science writing, helping make science communication less foreign and forbidding to those accustomed to technical writing. Real differences notwithstanding, comparisons reveal stylistic and narrative commonalities between even the most accessible and the most specialized texts. Consider the rather technical explanation of coevolution in *New Phytologist*:

> According to Darwin's hypothesis, **selection on the pollinator** FAVOURS longer proboscides to achieve easy access to the nectar, while **selection on the plant** FAVOURS longer corolla tubes, **which** ENSURE the pollinator's contact with the reproductive parts and thus MAXIMIZE pollen transfer. **This**

> **kind of selective regime** CAN LEAD to reciprocal coevolution **that** ESCALATES the length of both traits. (Paudel et al. 1402; in-text references omitted)

This is undeniably more difficult, and less narrative, than the previous texts. Darwin, plants, and pollinators all appear, but because they are excluded from subject and topic positions, it is a stretch to call them characters. Yet the passage does exhibit some narrativity, produced by the topic string foregrounding *selection* as a consistent albeit abstract subject-character. Even abstractions can become legible as characters if they recur consistently enough in strategic locations (Williams 27). Had the authors chosen a *different* abstraction for each subject the passage would be even less narrative. The accounts in *New Phytologist* and in the *National Geographic* blog thus differ in degree of narrativity.

The same is true even of highly simplified accounts. Consider Isabella Armour's folksy account on *Botany Thoughts*, an amateur plant-themed blog hosted by *Medium.com*:

> Say **a Sphinx moth** GOES UP to a Star Orchid and STICKS its long proboscis into the flower's deep nectar spur. To get all the way down to the nectar, **the moth** WILL HAVE TO PUT its face on the flower. If **the spur** IS long enough, **it** WILL FORCE the moth [to] get so close to the flower that **it** GETS COVERED in pollen. Then **the moth** GETS the food reward and GOES to the next flower to get more food.

Unsophisticated as it may seem, this passage features the same syntactic patterns targeted by LRS principles. Different as Armour's characters and actions are from those of Paudel et al., both texts similarly manage those elements in ways that facilitate reading, engagement, and comprehension.

These insights extend to writing in scientific journals, an observation that many emerging scientists find illuminating, since it helps reduce the perceived gulf between specialized and public writing. Even specialized scientific texts vary in narrativity, not only among different journals and articles but also within articles. Articles in generalist journals are more narrative than those in specialized forums, as the following passage from *Nature*, in contrast with the *New Phytologist* excerpt, suggests:

> [W]ithin a population, **the plants with the longest nectar spurs** HAVE a selective advantage because **their reproductive organs** optimally CONTACT pollinators and thus **they** ACHIEVE the greatest reproduction, whereas **pollinators with the longest tongues** HAVE a selective advantage because **they** OBTAIN the largest food reward. **Spur length and pollinator tongue length** then COEVOLVE by following gradually shifting adaptive peaks. (Whittall and Hodges 706; in-text references omitted)

Other high-narrativity accounts might strategically place moths and orchids themselves, as opposed to anatomical parts of them, in subject-character positions. The spectrum of narrativity carries over distinctions between scholarly, technical writing, and educational, entertaining communication. The following account by David Hone falls somewhere between accounts quoted above:

> **Some species of plants and insect** EVOLVE complex relationships where **both** CAN BENEFIT – if **the insect** IS the only one **that** CAN ACCESS the nectar

> **it** IS GUARANTEED food **others** ARE DENIED, while **the flower** further REDUCES the risk of misdelivered pollen and CAN BACK on its investments.
>
> **One way of restricting access to nectar** IS to elongate the part of the flower **that** HOLDS this sugary liquid, ensuring that only **the longest-tongued of insects** CAN REACH it. **Orchids** CAN TAKE this to extremes and **it** WAS one such flower **that** LED to the creation of a famous hypothesis by the most famous biologist.

Hone swings from the first, high-narrativity paragraph (with "plants and insects" as subject-characters) to the second, whose abstract subjects approximate the style of specialized writing. This is not a failure to maintain narrativity: the high-narrativity first paragraph equips readers to navigate the difficulties of the lower-narrativity second. In telling science stories, then, it may help to frame the key difference between specialized and popular texts not in terms of whether a text tells *a* story but, rather, in what kind of characters it features, and for what length of continuous discourse.

The comparative approach above suggests a way to teach science storytelling, with the added benefit of instilling proven principles for clear writing. Workshopping such comparisons with students is conceptually illuminating but also practically empowering, providing workable revision strategies for improving clarity and reach. Having used Williams's *Style* to teach science writing for ten years, I sensed that while many students learn to use LRS principles as rules, few acquire a working sense of the principles' underlying theory. Only recently, when I started presenting them *as* narrative principles, have I seen students grasp the theory profoundly enough to use it flexibly, as a holistic approach to style and narrative rather than a set of discrete, mechanical strategies. Comparison can also form the basis for creative exercises to reinforce LRS principles while demystifying the *storytelling* side of science storytelling. Students might be prompted, for example, to rewrite Hone's text for three different audiences, or with three different primary characters. Such exercises could also facilitate interdisciplinary collaboration between science communicators with very different training or expertise—scientists, journalists, novelists, policymakers and more. A narrative-centric approach to LRS principles appears to work as well in workshops on public outreach as in specialized writing courses. As I hope the comparisons above have suggested, a narrative approach can help science communicators understand the range of ways science stories can be told, as well as how to match the narrativity of their writing with their communicative purposes and the needs of their audience.

Conclusion

The approach suggested above is a modest step toward more thoroughgoing engagement between science communication and narrative theory. It is relatively easy to apply and requires minimal theoretical sophistication. But there is still much work to do. As part of a greater pedagogical endeavour, we might also aim to use creative writing for teaching scientific theories and models (Corni et al. 251). Alongside practical programs for putting science storytelling on firmer theoretical ground, I hope to see more analytical and theoretical research on the narrative elements inherent in scientific models and descriptions. Narratology has long mined innovative novels for concepts and models; why not do the same with scientific texts? With common ground between science and storytelling largely unexplored, narratology could be the *science of story* we need to tell compelling stories of science. In the short term, though, a narrative interpretation of LRS principles offers the beginnings of a practical program for taking science storytelling beyond the same old story.

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