HIXON WRITING CENTER

SCIENTIFIC STORYTELLING

This handout discusses how scientific narratives, such as in journal articles, compare with other types of storytelling. We share a narrative structure (the ABT template) that is especially useful for analyzing models and crafting your own scientific narratives. We also highlight sentence-level elements that are characteristic of scientific storytelling and are important to employ consciously when tailoring to different audiences.

SCIENTIFIC NARRATIVES VERSUS OTHER STORYTELLING

A common storytelling template is **The Hero's Journey** (Fig. 1), which describes a character who embarks on a journey, faces challenges, and is transformed or victorious through their experiences (Campbell, 2003, 2008). Scientific storytelling differs in that the scientific methods and findings are emphasized rather than the characters/ scientists. Scientific narratives do, however, retain the **Problem** and **Solution** dynamic of the cycle and transition between **Known** and **Unknown** realms (Fig. 2), thereby parallelling the challenge-revelation dynamic within the Hero's Journey.

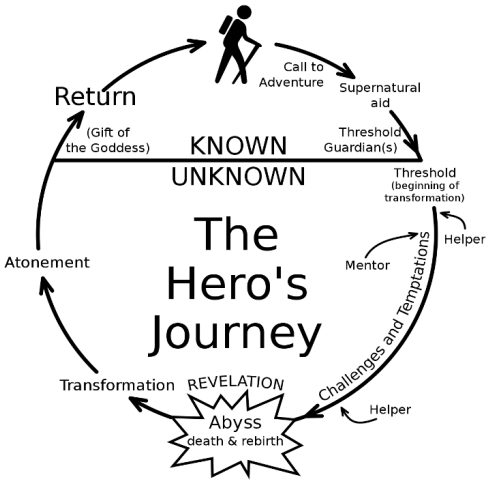

Fig. 1: The classic storytelling framework of a hero's journey through a Challenge-Revelation scenario. Figure from Vogler (1985).

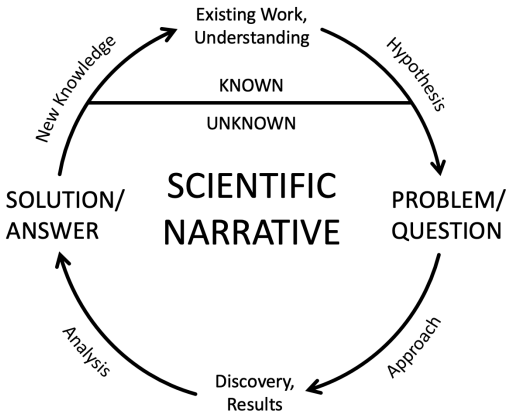

Fig. 2: How scientific narratives parallel The Hero's Journey, boiling down to the Problem-Solution or Question-Answer.

In a journal article, an effective Introduction section tends to mention a Problem (alternately framed as a Question, Challenge, Need, or Gap in Knowledge in the field), which the study addresses with their Solution, often presented in terms of the approach taken to solve the problem or fill the gap. The Introduction might simultaneously include a setup of what is broadly Known in

the field and then narrow to the Unknown, especially by mentioning how prior studies have helped solve some parts of the problem but still have limits that motivate the current work. We recommend looking for such components in journal articles to take note of the flow of ideas and signal wording that other writers employ in their writing (see Exercise 1 below).

In contrast to journal articles, which tend to emphasize the research process and results, other genres meant for more general audiences often incorporate the scientists directly into the stories. For instance, you may notice popular science or news articles naming specific scientists, putting them into the context of how a discovery happened, and even including quotes from such characters (see Exercise 2). The writers thereby translate the storytelling back into a form more like the Hero's Journey that is usually more accessible for wider audiences.

Exercise 1: Identifying the Problem-Solution Dynamic in a Journal Article

Analyze an Introduction section of a journal article by noting in the margins where you find elements such as the Problem (or Question, Challenge, Need, Gap) and Solution (Answer, Discovery). Our handout *Reverse Outlining for a Scientific Article* also details this annotation technique: https://writing.caltech.edu/documents/24103/ReverseOutliningScientificWriting.pdf.

Exercise 2: Comparing Pop-sci & Journal Articles

Find a popular science or news article and compare/contrast with a journal article on the same topic by looking for differences in problem-solution framing and mention (or not) of characters.

THE ABT TEMPLATE: AN EFFECTIVE NARRATIVE STRUCTURE FOR SCIENTIFIC STORIES

The **ABT (And - But - Therefore)** storytelling framework is a communication tool described by scientist and filmmaker Randy Olson, who noticed that this storytelling pattern used widely in the film industry is also applicable to scientific narratives (Olson, 2015). Olson defines narrative as "the series of events that occur in the search for a solution to a problem," and the ABT template is a Problem-Solution formulation that starts with capturing the Context (setting the stage with existing knowledge in the "And" component), followed by the Problem ("But") and then the Solution ("Therefore").

Example ABT:

*(**AND**) The detachment of subducted tectonic plates is a process that has been increasingly associated with collisional scenarios and the end of subduction in various locations worldwide. **(BUT)** However, there is little understanding of the causes and dynamics associated with three-dimensional (3-D) slab tearing, especially in the case of ridge-trench collision. Here we (**THEREFORE**) show using fully dynamic 3-D numerical models that the process of detachment due to ridge-trench collision depends on the geometry of the ridge segments approaching the trench.* (Modified from journal article abstract by Burkett and Billen (2010)).

Common ineffective narrative styles include AAA (And - And - And), which lists info with no clear problem and solution, or DHY (Despite - However - Yet) with too many problems or narratives (Fig. 3).

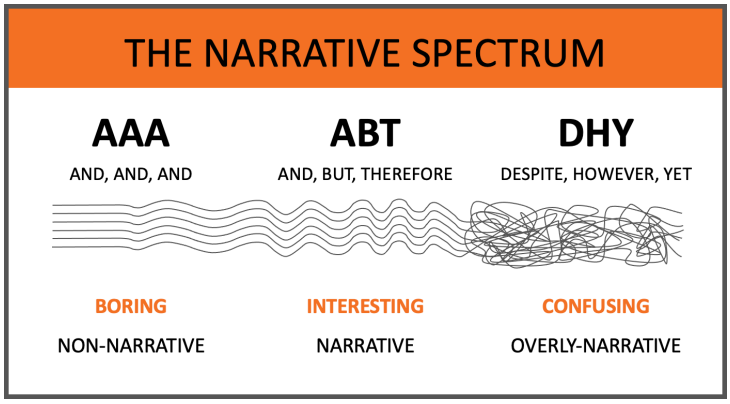

Fig. 3: Spectrum of narrative styles.
Adapted from https://entomologychallenges.org/wp-content/uploads/2018/10/abt-shorthand-reference-card.pdf

Example AAA:

*Slab detachment is a transitory process marking the end of subduction. Many studies have focused on the dynamics of subduction initiation **and** self-sustaining subduction. The propagation of slab detachment has **also** been described in conceptual models **and** may lead to surface effects such as slab gap volcanism **and** uplift. We present results of two-dimensional (2-D) **and** three-dimensional (3-D) numerical models that constrain the rheologic controls on the dynamics of slab detachment.*

Example DHY:

*Slab detachment is a transitory subduction process that few studies have investigated using realistic numerical modeling. Subduction modeling has largely focused on Newtonian rheologies **despite** the need to update to more realistic non-Newtonian dynamics. **However**, numerical solvers struggle with resolving the higher viscosity ranges, **yet** the geophysical observations indicate rapid dynamics for the detachment process while also showing inconsistencies in timing across different regions.*

Another form of ABT is the more informal **conversational ABT (cABT)** (Olson, 2015), which leaves out the technical details in order to identify the type of problem-solution dynamic by using only the general signal wording. For instance, you might capture the skeleton of your story with a cABT like one of the following:

- *There's something useful, BUT we don't know enough about it yet, THEREFORE we are trying to learn more about it.*
- *We need something, BUT we don't have it (or parts to make it), THEREFORE we are getting the stuff we need for it.*
- *We have a useful thing, BUT it's not good enough yet, THEREFORE we need to improve it.*

The first example above works as a cABT for the ABT example on the prior page, or it could be worded slightly more specifically as, "There's an important process, BUT we don't know enough about it yet, THEREFORE we are simulating the process to better understand how it works." The value in cABT framing is that it forces you to use the **signal wording** that helps indicate the problem and solution components without getting lost in the technical details and jargon. This type of framing helps widen the accessibility of your writing since such signal wording even within technical ABTs helps clarify for expert readers as well as allows a reader who doesn't know the jargon to follow the larger story dynamic, as in the example below.

Example ABT using both technical language and accessible signal wording:
*We employ a numerical geodynamic code that is **useful for** modeling subducting plate rheology **AND** mantle dynamics, **BUT** the **complexity** of plate and mantle viscosities is **challenging** for computational solvers to **resolve robustly**. **THEREFORE,** we determine the **ideal** parameters **for resolving** non-Newtonian flow at high resolution **to better capture** complex subducting plate dynamics.*

Below are some exercises for deepening your understanding of these types of narratives:

Exercise 3: Scavenger Hunt for ABT Narratives within Article Abstracts
Gather a few journal articles, read their abstracts, and underline and/or annotate to mark the A, B, and T components in the margins where you find phrases or sentences that capture the ABT.

Exercise 4: Writing an ABT or cABT narrative
Write a 1-3 sentence ABT (technical and/or plain language) or a cABT about your own research.

SENTENCE-LEVEL DIFFERENCES IN STORYTELLING: PASSIVE VERSUS ACTIVE VOICE

Scientific writing tends to avoid direct naming of characters, which leads to an increased prevalence of **passive voice** and **nominalizations** at the sentence level. You may have heard of passive voice (e.g., "X was shown" versus active voice "we show" or "the model showed"), which is more commonly recognized and discussed than nominalizations. Nominalizations are created when a verb or adjective is used as a noun (e.g., "conclusion" is a nominalization of the verb "to conclude" and "precision" is a nominalization of "precise").

Opinions vary as to how much one should or shouldn't write in passive voice in scientific writing. Journals sometimes encourage awareness of such usage, as with *Science's* recommendation:

> Use active voice when suitable, particularly when necessary for correct syntax (e.g., 'To address this possibility, we constructed a λZap library...,' not 'To address this possibility, a λZap library was constructed...').

The *Astronomical Society of the Pacific* even more strongly recommends (with quantification!):

> Use active voice as much as possible, and avoid passive voice as you would avoid the Ebola virus. This means writing 'Astronomers discovered a new planet' (active voice) rather than 'A new planet was discovered by astronomers' (passive voice). You should write less than 10 percent of your sentences in passive voice.

The key is to understand how passive voice and nominalizations work so that you have an awareness of the effects on readers and can use them wisely to maximize clarity for your target audience. We identify these elements below using a translation of the Little Red Riding Hood story into passive voice, modeled after Williams (2007).

- **Example using Active verbs and characters**:
  "Once upon a time, **Little Red Riding Hood was walking** through the woods on the way to her **Grandma's** house when the **Wolf jumped** out from behind the tree and **surprised her**."
- **Example using Passive voice & *nominalizations***:
  "Once upon a time, ***a walk*** **was conducted** through the woods to a house when ***a jump*** from behind a tree **resulted** in surprise."

Notice how the use of passive voice removes the characters, which is a sentence-level equivalent of the tendency to take the "hero" out of the journey in scientific narratives, as

discussed earlier. Since sentences still need a subject, the passive formulation sometimes causes verbs to become nouns, like in the above example where the verb "to walk" becomes a nominalization, "a walk." The use of nominalizations, also called "Zombie Nouns" (Sword, 2012), is common alongside passive voice within academic writing, and experts become accustomed to navigating this style of writing. However, passive voice and nominalizations in excess can cause the writing to feel more abstract and less engaging as it slows even expert readers and causes wider audiences to feel that the writing is less clear and accessible.

Using passive voice and nominalizations is not inherently bad or wrong, since they can help add variety within your writing or create a tone of formality that fits some audiences' expectations. The use of passive voice can also help with cohesion to connect meaning between sentences. We therefore recommend that you learn to recognize such elements, use them consciously and wisely, and minimize their usage for more general target audiences to improve clarity and accessibility.

Exercise 5: Identify the nominalizations and passive vs. active verbs in these sentences

- *Our lack of data prevented evaluation of actions targeting funds to areas in need of assistance.*
- *Because we lacked the data, we could not evaluate whether the organization had targeted funds to areas that needed assistance.*

Exercise 6: Recognizing Passive Voice and Nominalizations in journal articles

Find an example journal article and highlight (e.g., different colors or underlining vs. circling) where you find usage of Passive Voice (e.g., "X was shown") versus Active Voice ("we/model show(s)"). Then look for Nominalizations (verbs/adjectives turned into nouns, such as "describe" → "description" or "precise" → "precision", although sometimes words like "result" or "approach" might be either a verb or nominalization depending how it is used in the sentence). You could also compare differences is usage of passive vs. active voice in journal articles versus pop-sci or new articles.

Works Consulted and Other Resources

We consulted a number of works on this topic to create this handout, and you'll find their references here. This is not an exhaustive list of all resources on this topic, and we encourage you to seek out additional resources as needed. Some references below, such as Bloomfield (2024), are not cited in this handout but are included in case useful for further reading.

Bloomfield, Emma Frances (2024), *Science V. Story: Narrative Strategies for Science Communicators*. Univ of California Press.

Burkett, E. R., and M. I. Billen (2010), Three-dimensionality of slab detachment due to ridge-trench collision: Laterally simultaneous boudinage versus tear propagation, Geochemistry, Geophysics, Geosystems, 11, Q11012, doi:10.1029/2010GC003286.

Campbell, Joseph (2003). *The hero's journey: Joseph Campbell on his life and work* (Vol. 7). New World Library.

Campbell, Joseph (2008), *The hero with a thousand faces*. Vol. 17. New World Library.

Olson, Randy (2015), Houston, We Have a Narrative: Why Science Needs Story, Chicago, The University of Chicago Press.

Sword, Helen (2012) Zombie Nouns video, https://www.youtube.com/watch?v=dNlkHtMgcPQ.

Vogler, C. (1985). A practical guide to Joseph Campbell's the hero with a thousand faces. *Hero's Journey*.

Williams, J. M. (2007), Style: Lessons in Clarity and Grace, 9th ed. New York, Longman.