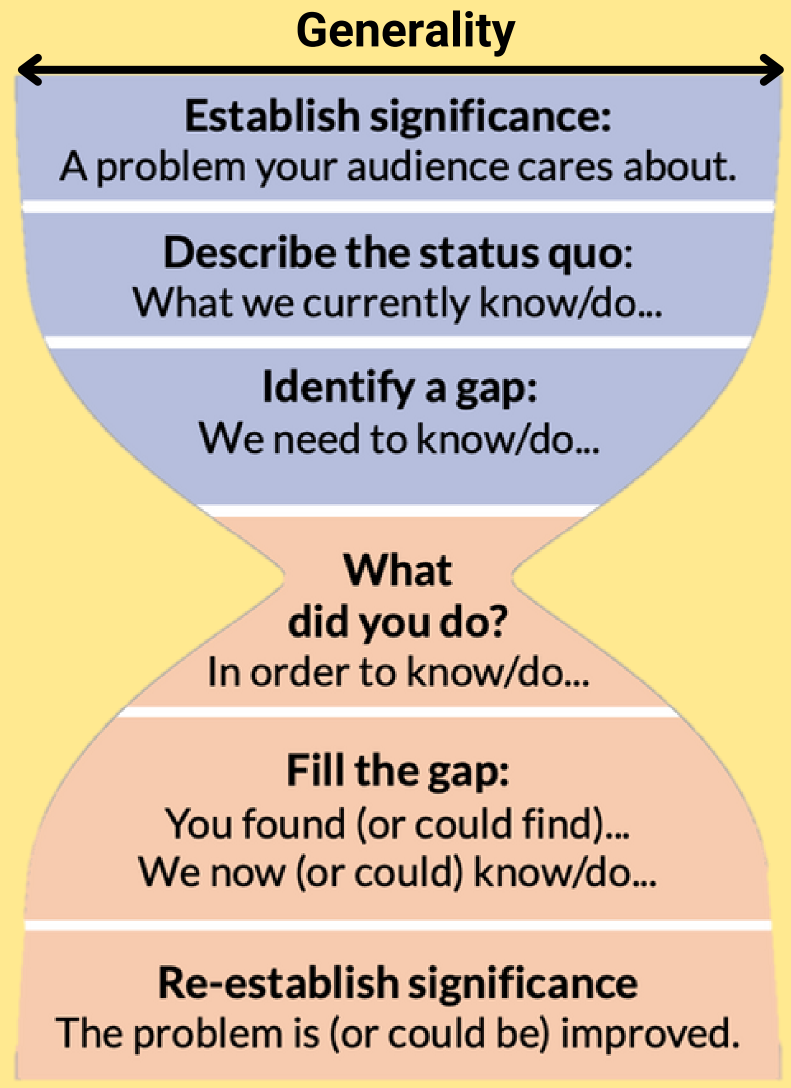
HOURGLASS COMMUNICATION

Hourglass Structure



The varying width of the hourglass represents the size of the intended audience for that section.

Why the Hourglass?

- It helps craft your work into a compelling story.
- It makes your work more accessible by placing emphasis on its motivation and implications.
- It can be adapted to any type of technical communication, including papers, posters, and presentations

For more communication resources:

AEROASTRO COMMLAB

Types of Hourglasses

The shape of the hourglass and the length of each section primarily depends on ***the audience:***

Highly-specialized journal
(e.g. *Additive Manufacturing)*

Scientific community at large
(e.g. *Nature*)

General interest
(e.g. *Scientific American*)

Images by Spiegelau, Waterford, & Hat Shark
Adapted from Dr. Ardon Shorr, Carnegie Mellon University

Hourglass Examples: Research Papers

(for a more general audience)

Establish big picture:
Craters on asteroids can give evidence from billions of years ago on how the solar system formed.

Establish significance:
Due to their incredible speeds and distant locations , asteroids will require autonomous systems for approach and landing

Describe status quo:
Current control techniques require an accurate model of the environment to control the spacecraft

Identify a gap:
Reinforcement learning (RL) has shown promise for this application due to its ability to learn control policies for a wide array of scenarios

What did I do:
We apply reinforcement learning to the asteroid landing problem

Fill the gap:
We found that RL is able to create more robust control policies than current methods

Establish significance:
Through our work, we have demonstrated the first RL algorithm for fully autonomous asteroid landing

(for an expert audience)

Establish significance:
Due to their incredible speeds and distant locations , asteroids will require autonomous systems for approach and landing

Identify a gap:
While model free RL allows us to develop control strategies for systems that are too complicated to model, their results are not guaranteed to follow basic laws of physics.

What did I do:
We apply a standard actor-critic reinforcement learning in conjunction with a physics informed neural network to constrain the control strategies of our work

We use mean pooling and multi-head attention to prioritize strategies that maintain safety throughout.

Fill the gap:
We found that our technique is able to create more robust control policies than other model free RL methods

Establish significance:
Through our work, we have demonstrated the first RL algorithm for fully autonomous asteroid landing

Paper: B. Gaudet, R. Linares, and R. Furfaro. "Six Degree-of-Freedom Hovering over an Asteroid with Unkown Environmental Dynamics via Reinforcement Learning", *AIAA Scitech 2020 Forum*

Poster created by Harsh Bhundiya