**Hourglass Structure**

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

**Generality**

- Establish significance: A problem your audience cares about.
- Describe the status quo: What we currently know/doing...
- Identify a gap: What we need to know/doing...
- What did you do? In order to know/doing...
- Fill the gap: You found (or could find)... We now (or could) know/doing...
- Re-establish significance: The problem is (or could be) improved.

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**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.

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**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*).

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**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 you 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.

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**(for an expert audience)**

- **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.
- **Fill the gap:** We use mean pooling and multi-head attention to prioritize strategies that maintain safety throughout.
- **Establish significance:** Through our work, we have demonstrated the first RL algorithm for fully autonomous asteroid landing.