HOURGLASS COMMUNICATION

Hourglass Structure

**Generality**

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

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.

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)

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 big picture:**
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.

**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.


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