Reproducibility is a key component of the scientific method. As computation becomes more central to the scientific enterprise, it is urgent to address concerns regarding reproducibility of computational results.

CSciBox addresses reproducibility concerns by:
- Tracks all actions taken with the core, for complete reproducibility.
- Includes citation notes every time you use another scientist's tool.
- Metadata is always bundled with the core data.
- We use linked open data formats.

It is easy (and mandatory) to CSciBox to save all the data and metadata that produced an age model (if you want to save the age model). By metadata, we mean specific parameter chains and such everything that’s required to replicate the computation exactly.

It is also easy (but optional) to save information about the other models that the scientist read but rejected. Something about why this is important for science too.

Hobbes’s knowledge base encodes the reasoning behind computation research. This reasoning may not always be reported in traditional scientific journals. The process of “elaborating” the rules of inference forces scientists to codify and report all of their reasoning. That’s cool!

The process of “the rules of everything that’s required to replicate the age model.” By metadata, we mean specific parameter chains and such everything that’s required to replicate the computation exactly.

Hobbes: We are at depth 3525 m. I will check whether the annual signals have faded to see if it’s appropriate for this core. Should we report the Baker model instead?

Winstrup: No, there are too many layer boundaries. Use \( \mu = 13 \) cm.

[Hobbes saves \( \mu=13 \) cm in the metadata and proceeds]

Argumentative reasoning

Hobbes considers arguments for and against each theory, and weighs their strength.

- This entails the way scientists think, and the way they communicate with each other—and thus streamline communication between Hobbes and its users.
- It also allows the scientist to consider multiple age models at once, and enables Hobbes to form conflicting arguments.
- In the process, for instance, the scientist can use the reasoning behind the selection of the suggested age models—or choose labeled models to explore both.
- This is the place in which material about scientific disagreements and conflicting claims.

Two components of confidence in the reasoning:

- **Confidence in the scientific knowledge underlying the rule:** This is the rule of inference itself. Confidence ranges from a strongly accepted rule (accepted), to a rule with no confidence.
- **A validity level is attributed to each rule, and determined by the expert geoscientist that created the rule. The degree of validity ranges from a strongly accepted rule (accepted) to a rule with no confidence at all (rejected).**

Hobbes’s Knowledge Base

Hobbes is aiming to encode the vast knowledge geoscientists have built up through years of experience dating cores. Hobbes’s collection of rules springs out of long, detailed discussions between the AI scientists and the geoscientists on the team. These conversations focus on:

1. The methods of reasoning geoscientists use to create & evaluate age models
2. Specific rules of inference geoscientists use in particular situations while creating an age model

Examples of rules obtained from these conversations include:

- The more measurements we have of a core, the more certain we will be about the resulting age model.
- Straight counting works well for layer counting if neighboring layers have roughly the same thickness.
- If a sediment layer contains fossils of terrestrial life, it must have been deposited on land.
- If the sedimentation rate changes abruptly, the age model is probably wrong.

The AI scientists then encode each rule of inference into an algorithm. Hobbes can understand.

CSciBox is open source

- Source code (Python) available on GitHub: github.com/akнеewski/csci
- But don’t you have to know Python to run it? We also have one-click installers there too.
- GitHub public license to modify/extend/use as you see fit!