

Creation of cultural artifacts

(i.e. stuff people can use)

Artifacts

- A thing, idea, writing, symbolic representation, etc, designed by humans for repeated use by humans
- An artifact is reused/reusable. It is not a single purpose, one time tool.

Examples of artifacts

- A Lemma or Theorem
- A mathematical paper
- A computer program
- A procedure within a computer program
- A package of programs
- An essay, poem, or book
- A computer
- A spoon

The same strategies which are used in the creation of artifacts can often also be applied for other things, such as learning new skills.

Recall scientific method:

- Observation
- Hypothesis
- Experiment
- Verification
- Adjust, repeat (adjust all things potentially: new observations, hypothesis, experiment, verification procedure!)

How are artifacts created?

generalized scientific method:

- Identify problem
- Conceptual design
- Construction/manufacture
- Check if problem solved
- Adjust, repeat (adjust all things potentially: problem, design, construction, checking procedure!)

Useful strategies:

- when identifying problems, construct testable criteria (this is the true power of scientific method)
- make these criteria “minimal” so that issues can be quickly identified, and positive reinforcement can be set up
- find correct level of generalization for the problem
- make problem/need as concrete/tangible as possible

Framing problem

- Start with initial “narrative”: [someone] wants to do [something] so that they can do [something else]
- Find correct level of generalization by asking first why and then how five times each

Designing Solution

- In parallel to design, create strategies to verify success/minimal progress (here, the how questions can often be useful)
- Do the thing: research/experiment/design/construct/create/program/write/...
- Check at first possible place
- Flow is good, positive reinforcement resulting from testing progress is also good!

Documentation and/or
journaling is the only sure way to
preserve sanity...

Documentation/journaling

- In general, a single sentence describing a new conceptual chunk (lemma, function, etc) is sufficient to not lose one's place

Evaluation

- Does it solve the problem? If you are making a single purpose tool and not an artifact, feel free to stop here.
- Otherwise...

Artifact-ness vs Single purpose tool-ness:

artifacts must stand up to certain basic human responses

- What is it? Can we come back to this item later and understand what it is?
- Why is it here? Can we come back to this item later and understand why we made it? Is it a function that was never called? Or a Lemma never used? Or a Theorem which will never be useful?
- Why does it work? Can we come back to this item later and understand how/ why it works? Do we understand the logic of the function we wrote? Or the proof of our Lemma? What if we need to alter its applicability?
- Why is it not trivial? Can we come back to this item later and understand why it took some effort? Will we be tempted to come back and do it over from scratch, not remembering the subtle points which held us up in its construction?
- For each of these, often a well placed word, phrase or sentence is often a sufficient answer!

Rinse, repeat

- most work time is in rewriting/editing/reflection
- after working through each cycle, readjust the framing of problem/level of generalization, the design strategy, evaluation criteria, etc
- inevitably, this process leads not only to a polished artifact, but to branching of new ideas, problems, methodologies
- talking to other people to help frame, develop, and evaluate ideas is essential!

Are we done?

- never really! that's the joy of creating an artifact.
more realistically, though, when do we move on?
- generalize to the “natural comfort zone” plus epsilon.
the future is uncertain, so best try to prepare
- work to minimize the effort/time investment
necessary to use the artifact later
- both of these steps significantly add to the time of
creation. but it's worth it!