ARRP (ARRay Processing)

What if we didn't assume our abstractions; what if we derived them?

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Abstract

ARRP is a homoiconic language designed to express the compilation of anything to anything through bottom-up abstraction via macros written in anything.

It's intended to serve as a minimal top-down to bottom-up abstraction turnaround point at as low of a level as possible. It is designed to be as unopinionated as possible.

This is done with compilation of code to machine language in mind, but it's open-ended.

Using ARRP without any libraries, you start at machine language with macros. Programming languages are just macro libraries.

Beware: it's not stable yet

Breaking changes should be expected for now. We need to get the core of the language right, and some iteration is inevitable.

Eventually the hope is to build a stable specification for everyone to implement.

Such that you're not flying completely blind, here are some anticipated breaking changes:
- Parallelized macroexpansion where possible
- Macro I/O details (inputs, return value etc).
- Changes to parameters and interfaces of builtin functions
- Changes to which builtin functions are exposed

This doesn't mean don't build stuff with arrp. This means use a pinned version of arrp for anything you need to stay working, and be ready for migration work.

1. Introduction

When we create abstractions, one common approach is to begin with a top-level interface we'd like to have, and then work down towards the layer below working out how to make it happen. This is top-down abstraction, and it's the default mode of operation for software development today.

There's another way, though, one pioneered by languages like lisp. Rather than starting from an ideal interface, we start with what exists now, pick a direction we'd like to go, and start working our way up towards a particular problem we'd like to solve. The abstraction that we create is simply the abstraction that logically forms when attempting to move in that direction. This is the bottom-up approach.

Many areas of science were formed using top-down abstraction by necessity. We made high-level observations about the world (salt goes away in water!) and created abstractions for those observations. As we came to understand the underlying mechanisms, the high-level layer was already established - so we 'make it work' to make our abstractions logically map together as well as we can. It's never perfect though. This approach lends itself to abstractions that don't logically map to eachother very cleanly.

By contrast, mathematics has largely evolved in a more bottom-up fashion. Each abstraction is built upon the previous, and what resulted is a ruthlessly logical and clean system.

These examples illustrate how bottom-up abstraction lends itself to a clean, well-mapped, less leaky design.

Of course, it's never perfect. Every layer leaks to some degree - even with the bottom-up approach - and we just work to keep it to a minimum. The benefit of minimizing abstraction leakage is huge, though: the less each layer leaks, the higher we can stack abstractions without accumulating frustrating behaviors and performance issues.

ARRP embraces the bottom-up philosophy. It is built for bottom-up abstraction (enabled by macros) to minimize abstraction leakage. In contrast to most lisps, it does not start at a high-level of abstraction, but starts right at the machine-language level.

2. ARRP's lifecycle: read → expand macros → print

That's it! That's the whole thing!

3. Language details

3.1. The *default* syntax

Emphasis on **default** because users of ARRP have control over this through reader and printer macros.

```
(hello)
```

3.2. The in-memory data structure

3.2.1. parray

3.2.2. barray

4. ARRP is a minimal core

Implementations of ARRP itself are extremely minimal. The version written in x86_64 assembly currently sets around 5,000 lines total.

Generally speaking, if it can be done inside the arrp language and not as a builtin, it should be.

5. What about portability?

6. Fully verifiable bootstrap is a goal

7. Structure of this repository

- impl - implementations of ARRP.
- docs - rendered docs for github pages (not user-facing)
- notes - almost anything
- programs - misc programs written in arrp