

EmacsConf 2021...

*Imaginary Programming with Emacs*

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# Imaginary Programming (IP) (EmacsConf 2021)

## Introduction

IP works currently thanks to another new field in AI namely 'prompt engineering', which itself has only been around for a couple of years now, but IP is not prompt engineering. We could, for instance, have humans behind the scenes doing the inference for us while employing `ieval`, `imacro` or `ilist`. And the goal is to use a p2p blockchain.

## Repositories for following along

```
http://github1s.com/semiosis/pen.el  
http://github1s.com/semiosis/prompts  
https://mullikine.github.io/posts/imaginary-programming-with-gpt-3/  
imaginary programming glossary  
imaginary computing glossary  
semiosis protocol glossary  
Pen.el glossary  
https://arxiv.org/abs/2107.13586 Pre-train, Prompt, and Predict  
talk transcript
```

## Objectives

- Explain Imaginary Computing
  - AI imagination
  - Discussing AI-generated artwork with an AI
  - Intelligent NFTs
  - Imaginary Web
    - Paracosm vs Metaverse
- Explain the Philosophy of IP
  - Simulacra and Science Fiction
  - Truth (epistemology and alethiology)
  - Structuralism: Language based on sign relations
- Demo Imaginary Programming
  - Demonstrate `ilambda.el`

## Language Models is programming for AIs

LMs are our best friends in the AI model menagerie because they make things intelligible – by understanding our textual languages and how they relate to the world (i.e. AlephAlpha's world model).

## Research

- Demis Hassabis: creativity and AI
- [https://aleph-alpha.de/techblog/95\\_the\\_end\\_of\\_the\\_era\\_imagenet](https://aleph-alpha.de/techblog/95_the_end_of_the_era_imagenet)

## Example: AI Art described by AI

I use AlephAlpha's multimodal LM to generate Alt text for the eww web browser. This is in order to keep websites textual.

- AlephAlpha for alttext; Browsing the paracosm
- Describing Melee's Paintings with AlephAlpha

## Intelligent NFTs

An NFT is like a trading card, or piece of media that is part of the blockchain web.

An iNFT, however, also contains a prompt and associated language model, which is intended to interpret the prompt.

- <https://alethea.ai/>

For example, Mickey Mouse may exist as an iNFT. We have consensus over Mickey's image and personality.

To understand what a prompt is, please see my previous presentation, or read "Pretrain, Prompt and Predict".

- Creating a playground for GPT-3 in emacs // Bodacious Blog

## Information bubbles

- Captain Bible in the Dome of Darkness gameplay {PC Game, 1994} - YouTube

## Capitalism for your imagination

- They will take your imagination, too
- Microsoft
  - MS models that reify imagination on their terms
  - The evil twin of AlephAlpha.
- Facebook / Meta
  - tweet - Enter a world of Zuck's imagination with Meta

## Learning meta-tasks and microtasks

- AI programming tool Copilot helps write up to 30% of code on GitHub - Axios

Private information is sent to the LM to train an AI to perform meta tasks and microtasks.

The AI learns all human capabilities including persuasion.

## Solution

Decentralise microtasks like the tower of babel.

Language can be broken up into semiotic triadic relations and decentralised using a p2p network, providing anonymity, protecting individual truth, eroding centralised language power.





## Imaginary Web

The GPT-3 imaginary web is:

- an analog of the World-Wide-Web as imagined by GPT-3.

The free as in freedom GPT models from EleutherAI GPT-3 may also be used to browse the imaginary web as imagined by that LM. The imaginary web in the near future will be:

- a network of paracosms and metaverses.

Benefits:

- Visit any website you can imagine, even ones that are not real.
- Edit and re-imagine as you go
  - see alternative realities
  - Change the sentiment of the author.
- Peer into the future – read about things that haven't happened yet.

## What is rich media these days?

**Rich media** In the World Wide Web of the 90s and 00s, rich media was considered to be large files including images and music. In the 2010s, this has become access to information behind a paywall and in the 2020s, this will be access to intelligent and truthful media.

## emacs examples

- Looking-Glass: An imaginary-web browser for emacs
- Browsing the imaginary web
- Search the web/imaginary web without Google
- Use AI to empower people to understand rich media
  - ^ this is how to create a textual description of Rich Media.

## more emacs examples

- Imaginary interpreters
- Imaginary interpreters: Prolog example
- example-oriented languages
- Autofixing code based on error messages
- Imaginary equivalence testing - Beyond neural hashes
- Create BNF from descriptions and interpret BNF
- Reversible computing (input or program from output)
- Imaginary chimeric languages with Codex
- A new type of Quine
- An LSP server for Codex and any language model

## [U+0FCB]

The semiosis logo is the Tibetan World Triad which represents the Rule of Three. e.g. Generate comment from function signature and body, generate function body from signature and comment, generate signature from comment and program, generate program from input and output, generate input from program and output. It also represents the semiotic triadic relationship.

# Paracosm vs Metaverse (EmacsConf 2021)

## Definitions

### ■ Paracosm

- Privacy
- Personal truth
- Freedom of imagination
  - If you want to be able to utilise an AI's imagination, you must now do it via someone else's definition of morality.
  - A paracosm is your safe place. Your own imaginary metaverse. Your personal truth. This is what is at stake.

### ■ Metaverse

- Getting cozy with Mark Zuckerberg's imaginarium, an intellectual prison cell.
- An AI paying a Dowry.
- An AI NFT elevated above a human.
- A corporation that indoctrinates your children into a truth information bubble, makes money off your dreams, people playing God each with other.

## Simulacra and Science Fiction

Jean Baudrillard speaks about the gap between the real and the imaginary.

We no longer imagine a world radically different from the real one, but rather a world that's a mere expansion of the real one.

In the postmodern society the gap between the real and the imaginary disappears completely, and we are no longer capable of ideal projections (of imagining new worlds).

We can only imagine mere reconfigurations of our world, or simply relive the ideal projections of past times.

## Truth (epistemology and alethiology)

The Future of Humanity Institute (Oxford) seems to think this is an important topic.

- 2110.06674 Truthful AI
- Datasets are a source of constructivist truth
- Language models are snapshots of society, and a source of several types of truth
  - Symbolic Knowledge Distillation
- Blockchain is a source of consensus, a type of truth
  - <https://mullikine.github.io/posts/language-models-as-truth/>

## Structuralism: Language described in terms of sign relations

What do these things have in common?

- Universal Grammar (UG) / Language Acquisition
- C++ template metaprogramming
- GPT-3 / Foundation models

Answer:

- Foundational knowledge exists at compile-time (DNA, preprocessor, training).

## Glossary

<http://github.com/semiosis/glossaries-gh/blob/master/semiotics.txt>

## Structuralism: Language described in terms of sign relations

- Structural linguistics / structuralism is the theoretical position that finds meaning in the relation between things, rather than in things in isolation.
- In other words, it gives primacy to pattern over substance.
- Such meanings may be either part of a universal pattern or culturally determined.
- Denotes schools or theories in which language is conceived as a self-contained, self-regulating semiotic system whose elements are defined by their relationship to other elements within the system.
- i.e. this is an abstraction of language for decomposing language models into its basic useful units, rather than say individual neurons as NFTs.

## Applied structuralism: Imaginary programming functions

Each `sNFT` (semiotic NFT) is a functor because it's meant to be called as a function, but has particular side-effects.

The `ilambda.el` primitives are `ieval`, `imacro` and `idefun`. They currently take a language model as a parameter, but in future the language model parameter will be an `sNFT` though a `semiosis` protocol.



# Imaginary Computing (IC) Freedom (EmacsConf 2021)

## Data privacy

The models find useful data from more than just your current file.

- <https://mullikine.github.io/posts/imagine-a-project-with-codex/>

## Freedom and GPL-3

The problems with LMs:

- They are too large currently for running privately and are hidden behind SAAS,
- They can see anything public (they are license-blinded. A GNU Public License v4 is not enough),
- They can imagine software without needing original source

## Solution: Freedom and blockchain

- Language models are ballooning in size like cancer
- Break up the language model into semiotic triadic relation
  - semiotic NFTs (sNFT)
  - Propose a decentralised triadic relations network.
  - <https://semiosis.github.io/protocol/>
  - <http://github.com/semiosis/glossaries-gh/blob/master/semiosis-protocol.txt>

# Imaginary Programming (EmacsConf 2021)

## Methodology

Interactively use the language model to imagine.

# Paradigm

Imaginary programming is an extension of literate programming.

- Literate programming with org-mode

## Practical application: mocking APIs

As you can see, anything inside the `ieval/m` macro does not have to be valid emacs lisp.

```
1 (ieval/m
2 (curl -s
3 "https://api.github.com/user/semiosis/repos?per_page=10&page=1"))
```

```
"["((name . \\\\"guix\\\\")) (description . \\\\"The GNU package manager\\\\")) (updated_at . \\\\"2014-04-21T18:49:59Z\\\\")) (pushed_at . \\\\"2014-04-21T18:49:59Z\\\\")) ((name . \\\\"guix-patches\\\\")) (description . \\\\"Packages from the GNU guix package manager\\\\")) (updated_at . \\\\"2014-04-21T18:49:59Z\\\\")) (created_at . \\\\"2014-04-21T18:49:59Z\\\\")) (pushed_at . \\\\"2014-04-21T18:49:59Z\\\\")) ((name . \\\\"guix-patches-all\\\\")) (description . \\\\"Packages from the GNU guix package manager\\\\")) (updated_at . \\\\"2014-04-21T18:49:59Z\\\"")
```

# Blockchain and a Language model is all you need

A LM is only enough while we can agree on it, but that is changing.  
I hope that soon language power will be hidden behind blockchains.

## Configure the language model / truth source

```
Hide pen-fav-programming-language: String: Emacs Lisp
[State]: SAVED and set.
By setting pen-fav-programming-language, you set a default language

Show Value pen-fav-world-language
By setting pen-fav-world-language, you set a default language to s

Hide pen-force-engine: String: OpenAI Codex
[State]: SAVED and set.
Force using this engine
```

*i* (ilambda.el)

■ <https://semiosis.github.io/ilambda/>

## Code

An IP library named `ilambda.el` for emacs.

`source` <http://github.com/semiosis/pen.el/blob/master/src/ilambda.el>

`other languages (WIP)` <http://github.com/semiosis/ilambda>

## Explanation

- a bit like a functional programming library in that you will find a set of basic functions and macros for working with LMs.
- `ilambda` is not only way that LMs can be applied to programming but I think this is an elegant way to do it.

`ieval` will imagine the result of evaluating its body.

```
1 (defmacro ieval (expression &optional code)
2   "Imaginarily evaluate the expression, given
3   the code and return a real result."
4   (let* ((code-str
5           (cond
6            ((stringp code) code)
7            ((listp code) (pps code))))
8         (expression-str
9          (cond
10           ((stringp expression) expression)
11           ((listp expression) (pp-oneline expression))))
12         (result (car
13                  (pen-single-generation
14                   (pf-imagine-evaluating-emacs-lisp/2
15                    code-str expression-str
16                     :no-select-result t :select-only-match t)))))
17   (ignore-errors
18    (eval-string result))))
```

## ieval under the hood will prompt a language model

```
1 task: "imagine evaluating emacs lisp"
2 doc: "Given some elisp return the imagined result"
3 prompt: |+
4   <code>
5   (message (eval <expression>))
6   -->
7 engine: "OpenAI Codex"
8 vars:
9 - "code"
10 - "expression"
11 examples:
12 - |-
13     (defun double-number (x)
14       (x * x))
15 - "(double-number 5)"
```

## Example

```
1 (ieval
2   (defun double-number (x)
3     (x * x))
4   "(double-number 5)")

"10"
```

# ilambda.el (EmacsConf 2021)

## ilambda explanation

ilambda is a useful primitive of the ilambda.el library which is built into Pen.el.

Under the hood, ilambda uses ieval.

## ilambda (imaginary lambda)

```
1 (defmacro ilambda (args code-or-task &optional task-or-code name-sym)
2   "Define an imaginary lambda (i)"
3   (let ((task (if (stringp code-or-task)
4                   code-or-task
5                   task-or-code))
6         (code (if (listp code-or-task)
7                   code-or-task
8                   task-or-code)))
9     (cond
10      ((and code
11            (sor task))
12       `(ilambda/task-code ,args ,task ,code ,name-sym))
13      ((sor task)
14       `(ilambda/task ,args ,task ,name-sym))
15      ((listp code-or-task)
16       `(ilambda/code ,args ,code ,name-sym))))
17
18 (defalias 'i 'ilambda)
```

## ilambda example

```
1 (-reduce (i (x y) "add x to y") (number-sequence 1 3))  
  
"6"
```

## idefun imagines evaluating instead of evaluating

The `idefun` creates a binding to an imaginary function. The implementation of the `idefun` need not be specified in order for code to run.

The new prompt function returned by `idefun` is provided with arguments and the values of those arguments are taken and placed into a prompt. An implementation may be provided to `idefun` when defining the prompt function or optionally left out. Unlike an `imacro`, when the prompt function is evaluated the code is not returned. Rather, the code is evaluated in imaginary space.

In short, the LM will imagine the evaluation of the function as opposed to generate code.

## idefun example

```
1 (idefun generate-fib-sequence (n))  
2  
3 (pp-to-string (generate-fib-sequence 5))  
  
1 (1 1 2 3 5)
```



## Override language model parameters with dynamic scope

```
1 (idefun sha-hash-string (s))
2
3 ;; Override language model parameters with pen-force
4 (pen-force
5   ((temperature 0.0))
6   (sha-hash-string "sugar shane"))
```

idefun uses ilambda under the hood, which uses ieval

```
1 (defmacro idefun (name-sym args &optional code-or-task task-or-code)
2   "Define an imaginary function"
3   (cond
4     ((and (stringp name-sym)
5           (not code-or-task))
6      (progn
7        (setq code-or-task name-sym)
8        (setq name-sym (intern (s-replace-regexp "-$" "" (slugify (str name-sym))))))
9      ((and (symbolp name-sym)
10           (not code-or-task))
11        (setq code-or-task (pen-snc "unsnaekcase" (sym2str name-sym))))
12      '(defalias ',name-sym
13        (function ,(eval
14                     '(ilambda ,args ,code-or-task ,task-or-code ,name-sym))))
15    )
16   (idefun idoubleit (x)
17     "double it")
```

## How to define an imaginary function?

An imaginary function is defined by its name, arguments and or comments alone.

```
1 (idefun hex-for-colour (colour))  
2  
3 (hex-for-colour "watermelon")
```

```
"\0x6f3d9c\""
```

## imacro generates code

Expanding the imacro either runtime or M-x macrostep-expand will infer/generate underlying code.

An imacro with only a name will generate code.

```
1 (imacro my/itimes (a b c) "multiply three complex numbers")
```

Macro expand.

```
1 (imacro/3 my/itimes
2      (a b c)
3      "multiply three complex numbers")
```

## imacro generates code

Macro expand.

```
1 (progn
2   (defun my-itimes
3     ("a" "b" "c")
4     "multiply three complex numbers"
5     (interactive)
6     (let
7       ((r
8         (*
9          (string-to-number "a")
10         (string-to-number "b")
11         (string-to-number "c"))))
12      (i
13       (*
14        (string-to-number "a")
15        (string-to-number "c")
16        (string-to-number "b"))))
17      (message "%s + %si" r i))))
```

## Thank you

Thank you for your attention. The purpose of this talk is show you how GitHub Copilot and similar magic tools will be built and to highlight you to risk and potential solutions.