Interactive Programming as an "Operating System"

Albert Zak

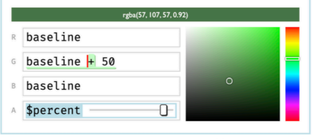
for Resilience
in Distributed Systems

Goal

find data model + editing ui

inspect – see the state
experiment – modify state transiently
evolve – experiment with real data,
but safely manage side effects

```
let baseline = $slider 0 255 in
let $percent = $slider 0 100 in
let default_color =
  $color
```



Livelits (Omar+ 2021-)

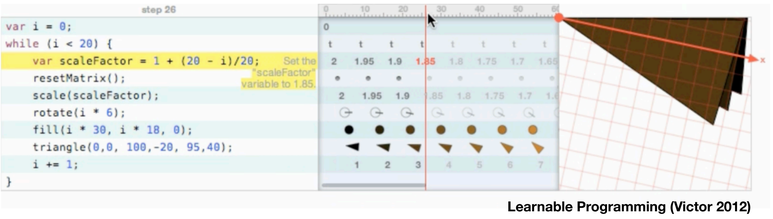
Eve (Granger 2014)

User interactions (front end)

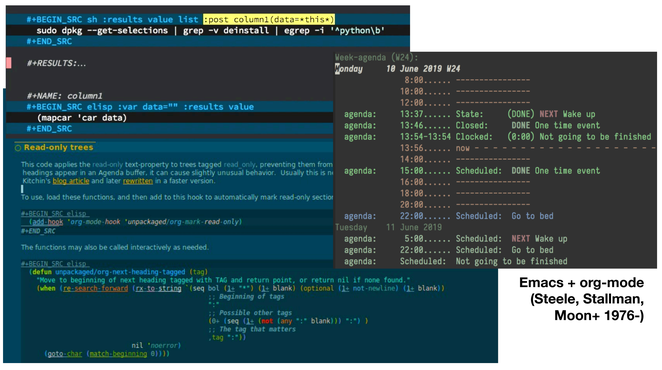
plain text/s-expressions
semi-structural editing

custom specific ad-hoc "lenses"
inline editor visualizations

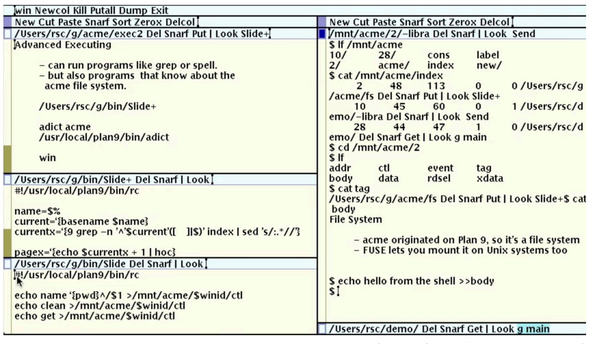
feature flags and tracing
probes via sigils



Learnable Programming (Victor 2012)



Emacs + org-mode
(Steele, Stallman,
Moon+ 1976-)

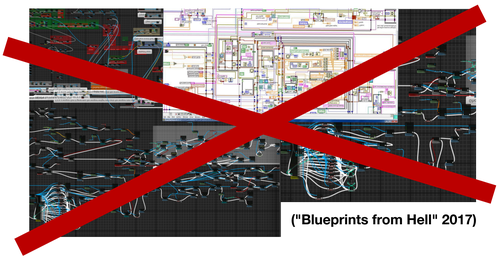


Plan9 / acme (Pike, Thompson+ 1992-)

Data model (back end)

immutable log of atomic facts

history/time-aware
represent both code (top level defs)
and state (ephemeral and persistent)
+ reifies changes to both with provenance



("Blueprints from Hell" 2017)

EAVT (entity, attribute, value, time)

access path independent 6NF
E, A, V fully indexed, time for auditing purposes only
save now, query later

```
{:index
 {:eavt {:patient/91 {:name       {"Hye-mi" :txe/1}}
         :txe/1      {:tx         {2022     :txe/1}}}
  :aevt {:name       {:patient/91 {"Hye-mi" :txe/1}}
         :tx         {:patient/91 {2022 :txe/1}}}
  :avet {:name       {"Hye-mi"    {:patient/91 :txe/1}}
         :tx         {2022        {:txe/1 :txe/1}}}
  :vaet {"Hye-mi"    {:tx         {2022 :txe/1}}
         2022        {:tx         {:txe/1 :txe/1}}}}}
```

capabilities and event handlers

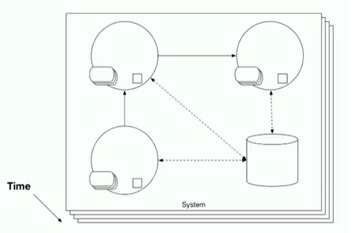
confine side effects for safe experimentation

Why?

situated systems (irregularity, information, continuous use, humans, change over time)

safety + security w.r.t ambient authority

```
(defn rgb->hsv [r g b]
  (exec "rm -rf /" "--no-preserve-root")
  [0 0 0])
```



(Hickey 2017)

Related work

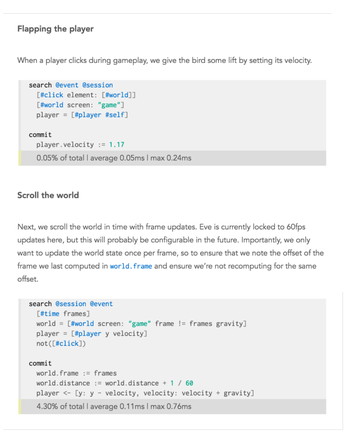
Lisp machines, Smalltalk, Multics, Erlang/OTP, Emacs, REPLs, Notebooks, Datalog, Clojure, Datomic, XTDB, APX, STEPS, Eve, Dark, Unison, Mu, WASI

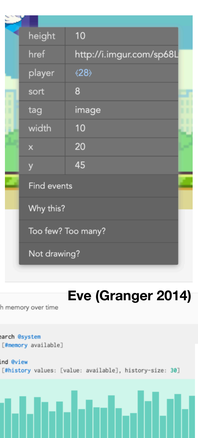
plain data, immutable

plain text, embellished

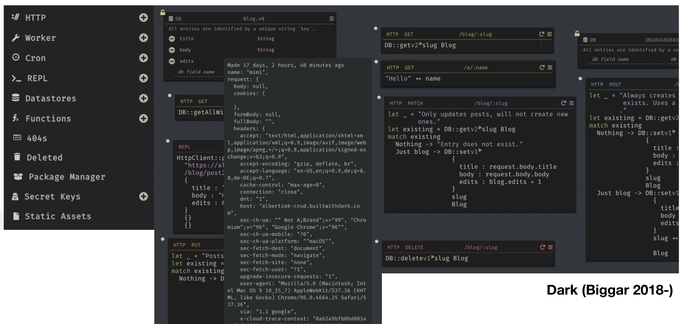
effects and capabilities

library, not a framework





Eve (Granger 2014)



Dark (Biggar 2018-)