

PERFORMANCE LECTURE

Anna + Mapau

Why do we want to optimize performance?

1 px = 4 bytes

640px

512px

1,310,720 bytes



D E M O T I M E

Making gl_clear really fast

How can we make this faster?



SPEED TIP #1

Reduce how many function
calls you make!

Can we make this faster?



SPEED TIP #2

Use optimization option flags when
you're compiling!

O1

```
-fauto-inc-dec  
-fbranch-count-reg  
-fcombine-stack-adjustments  
-fcompare-elim  
-fcprop-registers  
-fdce  
-fdefer-pop  
-fdelayed-branch  
-fdse  
-fforward-propagate  
-fguess-branch-probability  
-fif-conversion  
-fif-conversion2  
-finline-functions-called-once  
-fipa-profile  
-fipa-pure-const  
-fipa-reference  
-fipa-reference-addressable  
-fmerge-constants  
-fmove-loop-invariants  
-fomit-frame-pointer  
-freorder-blocks  
-fshrink-wrap  
-fshrink-wrap-separate  
-fsplit-wide-types  
-fssa-backprop  
-fssa-phiopt  
-ftree-bit-ccp  
-ftree-ccp  
-ftree-ch  
-ftree-coalesce-vars  
-ftree-copy-prop  
-ftree-dce  
-ftree-dominator-opts  
-ftree-dse  
-ftree-forwprop  
-ftree-fre  
-ftree-phiprop  
-ftree-pta
```

O2

```
-falign-functions -falign-jumps  
-falign-labels -falign-loops  
-fcaller-saves  
-fcode-hoisting  
-fcrossjumping  
-fcse-follow-jumps -fcse-skip-blocks  
-fdelete-null-pointer-checks  
-fdevirtualize -fdevirtualize-speculatively  
-fexpensive-optimizations  
-ffinite-loops  
-fgcse -fgcse-lm  
-fhoist-adjacent-loads  
-finline-functions  
-finline-small-functions  
-findirect-inlining  
-fipa-bit-cp -fipa-cp -fipa-icf  
-fipa-ra -fipa-sra -fipa-vrp  
-fisolate-erroneous-paths-dereference  
-flra-remat  
-foptimize-sibling-calls  
-foptimize-strlen  
-fpartial-inlining  
-fpeephole2  
-freorder-blocks-algorithm=stc  
-freorder-blocks-and-partition -freorder-functions  
-frerun-cse-after-loop  
-fschedule-insns -fschedule-insns2  
-fsched-interblock -fsched-spec  
-fstore-merging  
-fstrict-aliasing  
-fthread-jumps  
-ftree-builtin-call-dce  
-ftree-pre  
-ftree-switch-conversion -ftree-tail-merge  
-ftree-vrp
```

O3

```
-fgcse-after-reload  
-fipa-cp-clone  
-floop-interchange  
-floop-unroll-and-jam  
-fpeel-loops  
-fpredictive-commoning  
-fsplit-loops  
-fsplit-paths  
-ftree-loop-distribution  
-ftree-loop-vectorize  
-ftree-partial-pre  
-ftree-slp-vectorize  
-funswitch-loops  
-fvect-cost-model  
-fvect-cost-model=dynamic  
-fversion-loops-for-strides
```

Can we make this faster?



SPEED TIP #3

Precompute values you're
planning to re-use!

Can we make this faster?



SPEED TIP #4

Only use **volatile** when
you really need to!

Can we make this faster?

0x0

0x4

0x0

0x4

char							
------	------	------	------	------	------	------	------

0x0

0x4

unsigned int	unsigned int
--------------	--------------



SPEED TIP #5

Minimize the number of loads and stores you do! Work with more bytes at once!

Can we make this faster?



SPEED TIP #6

If you want to write 8 bytes at a time, you can use the **long long** data type!

Can we make this faster?



SPEED TIP #7

Unroll your for-loops >:)

Can we make this faster?



SPEED TIP #8

Use the cache!

Can we make this faster?



SPEED TIP #9

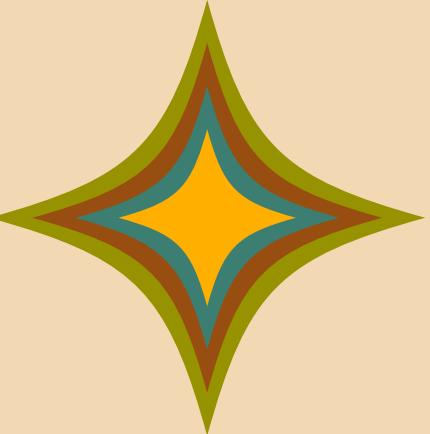
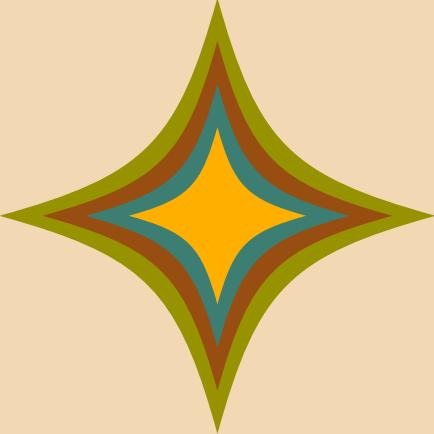
The lower-level you get, the more you can MAXIMIZE your EFFICIENCY

1000x faster!!

Speed vs. style

Not everything should be treated
as an optimization problem!

THE GROOVY CS107E PROJECT LECTURE!



created by liana™

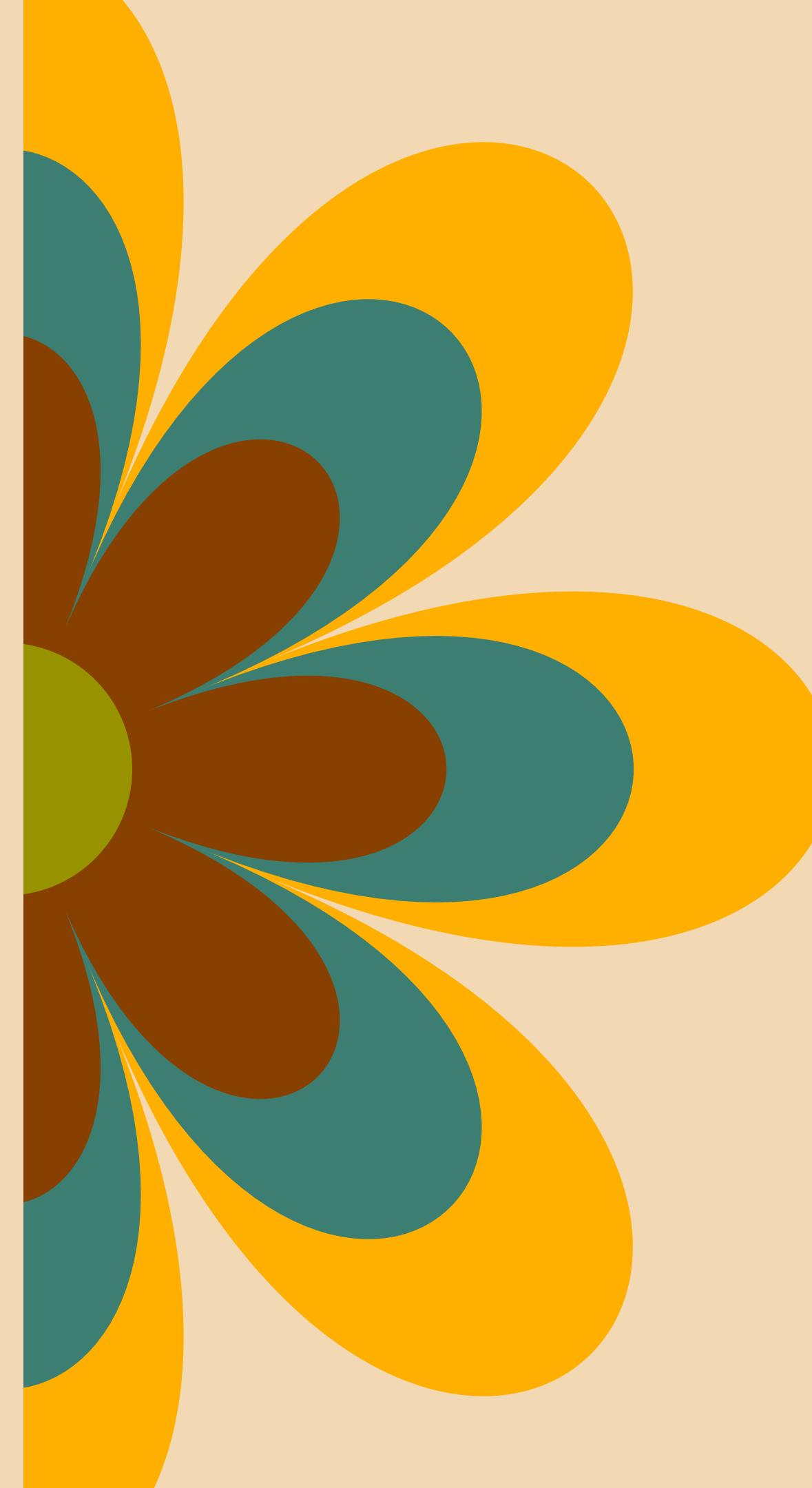
presented by mapau™

and anna™

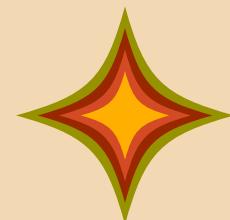
2022

HOW TO COME UP WITH A PROJECT

- ❖ hobbies + passions
- ❖ fixing daily annoyances
- ❖ further os / assignment exploration



HOW TO COME UP WITH A PROJECT



hobbies +
passions



fixing daily
annoyances



further os /
assignment
exploration



HOW NOT TO COME UP WITH A PROJECT



my friend / some rando
on the internet did this
before so it will be easy!



"ok but lowkey liana,
what's the min
expectation for grade x"



i'm like super into
machine learning so
that on a pi i guess



british people bake
but really politely

baltimore drugs, politics,
education, economics,

EXECUTION VS. COMPLEXITY



heat did not help
baker terry :(



but peter
kept it
simple!



EXECUTION VS. COMPLEXITY

both survived the gbbo chocolate week season 9!

WHEN A USER TAKES A PHOTO,
THE APP SHOULD CHECK WHETHER
THEY'RE IN A NATIONAL PARK...

SURE, EASY GIS LOOKUP.
GIMME A FEW HOURS.

...AND CHECK WHETHER
THE PHOTO IS OF A BIRD.

I'LL NEED A RESEARCH
TEAM AND FIVE YEARS.



IN CS, IT CAN BE HARD TO EXPLAIN
THE DIFFERENCE BETWEEN THE EASY
AND THE VIRTUALLY IMPOSSIBLE.

COMPLEXITY: WE ARE HERE TO HELP!

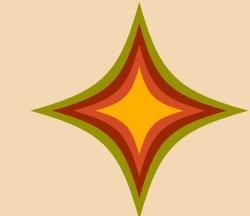
what is hard? ??

math is hard



mechanical
integration is hard

fancy timing can be
hard (esp comms)



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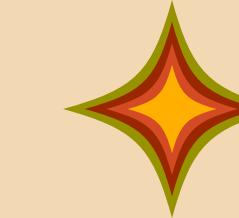


fancy timing can be
hard (esp comms)



gpu stuff is hard -->

mechanical
integration is hard



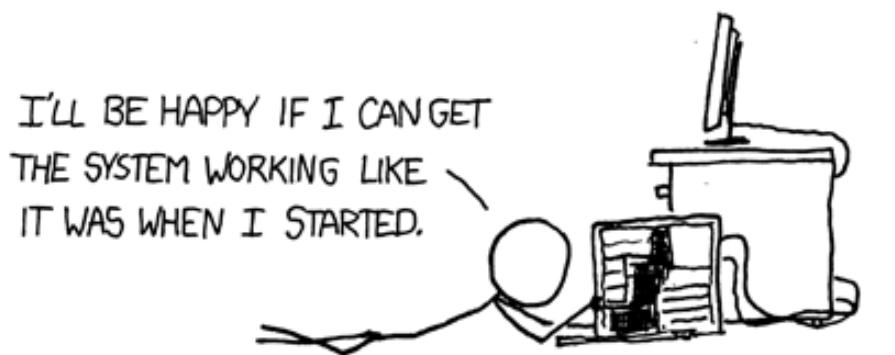
bad/no
documentation is
rude and hard

AS A PROJECT WEARS ON, STANDARDS
FOR SUCCESS SLIP LOWER AND LOWER.

0 HOURS



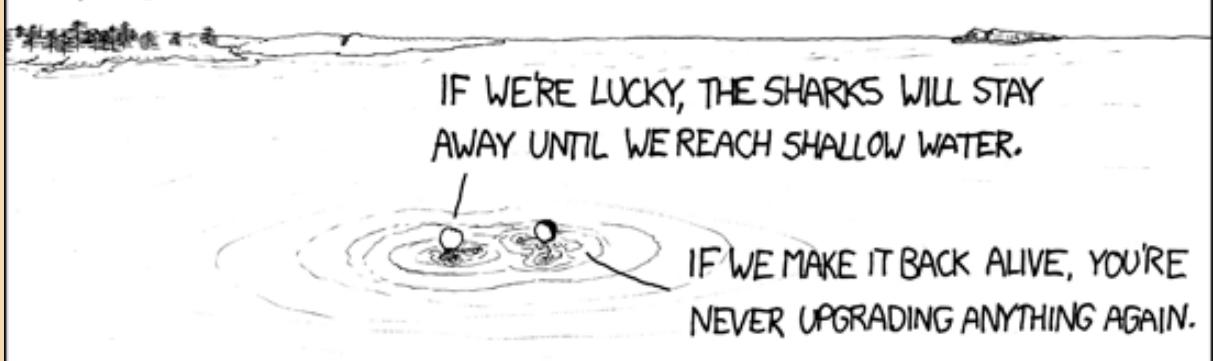
6 HOURS



10 HOURS



24 HOURS



IF YOUR PROJECT SHOULD
BE BUILT WITH AN OS

MAYBE DON'T TRY TO
BUILD IT WITHOUT ONE

unless it's building an os... haha jk... unless

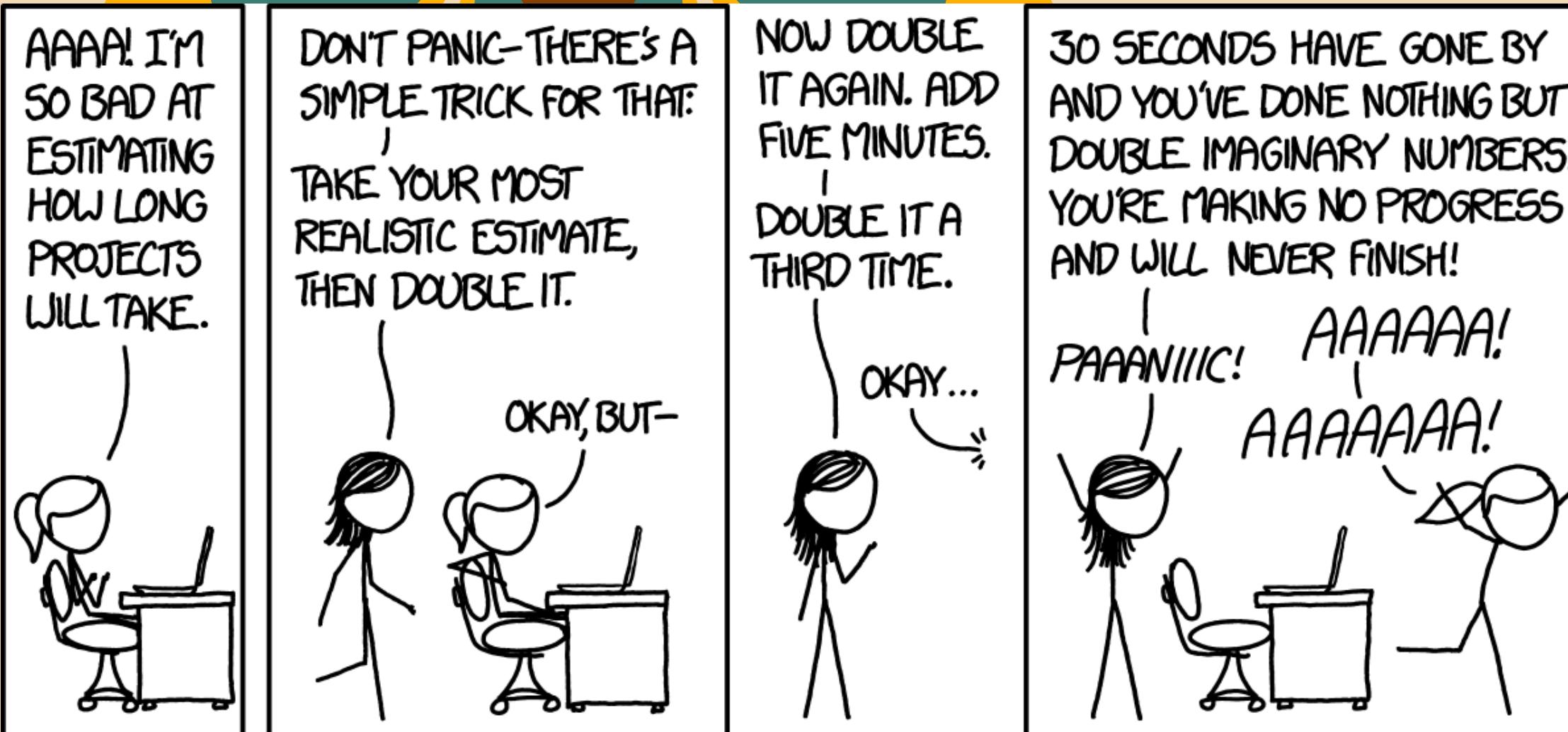
BUILD UP
BUILD UP



in other words it is ok if your bagel
is not rainbow

BUT PLAN SO YOU
DO NOT PRESENT
WITHOUT A BAGEL
AT ALL

TIME... IS HARD



```
void print_cold_hard_truth(void) {  
    printf("being good at something  
does not make you good at  
knowing how long something will  
take");  
  
    // :(  
}  
}
```

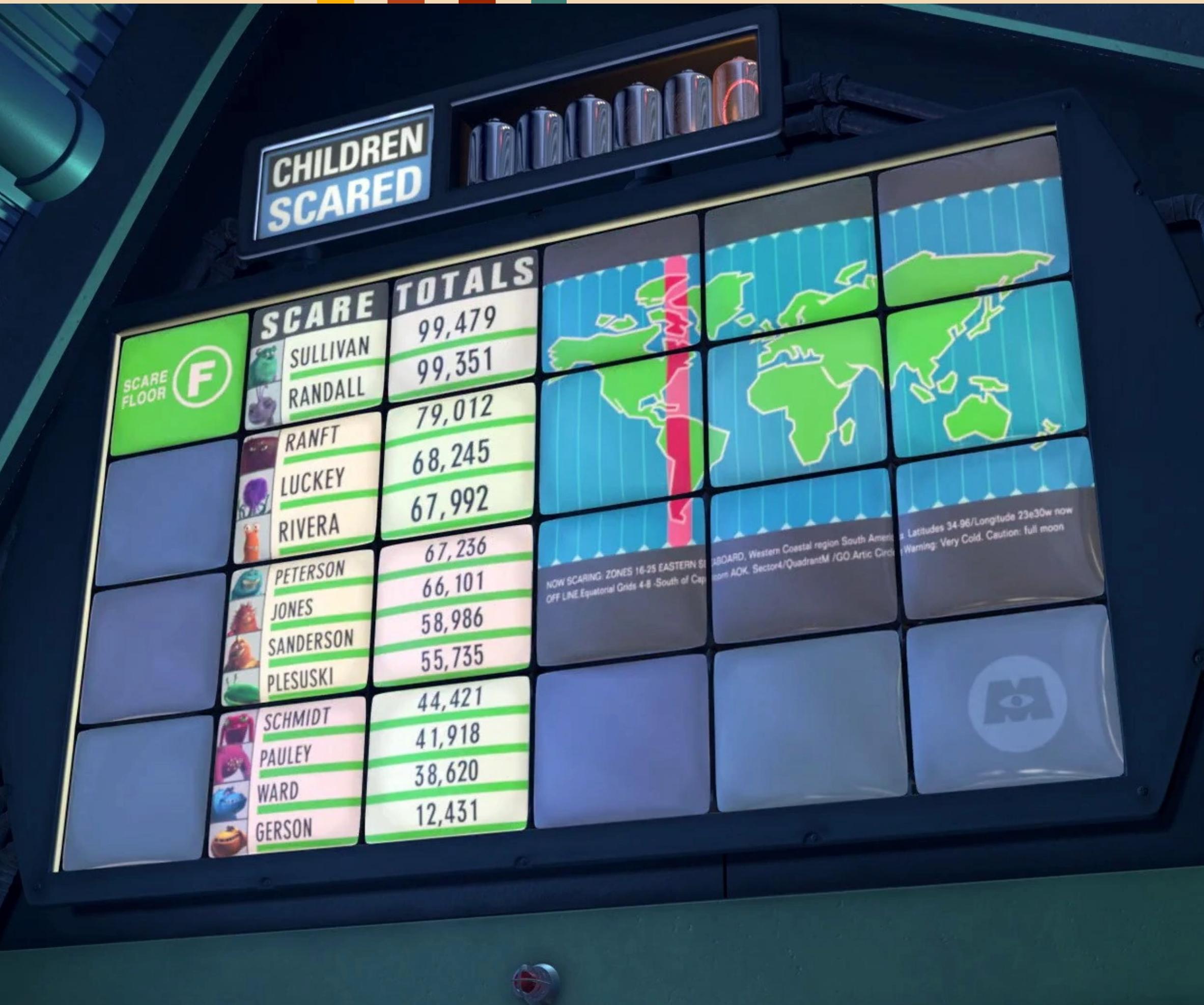


BE LIKE SCULLY & MIKE

each person needs to have their own discrete responsibilities: how can both people always be making progress?



**BE LIKE
SCULLY & MIKE:
DISCRETE JOBS
= HIGHER SCARE
TOTAL = 107E
SUCCESS**





Me

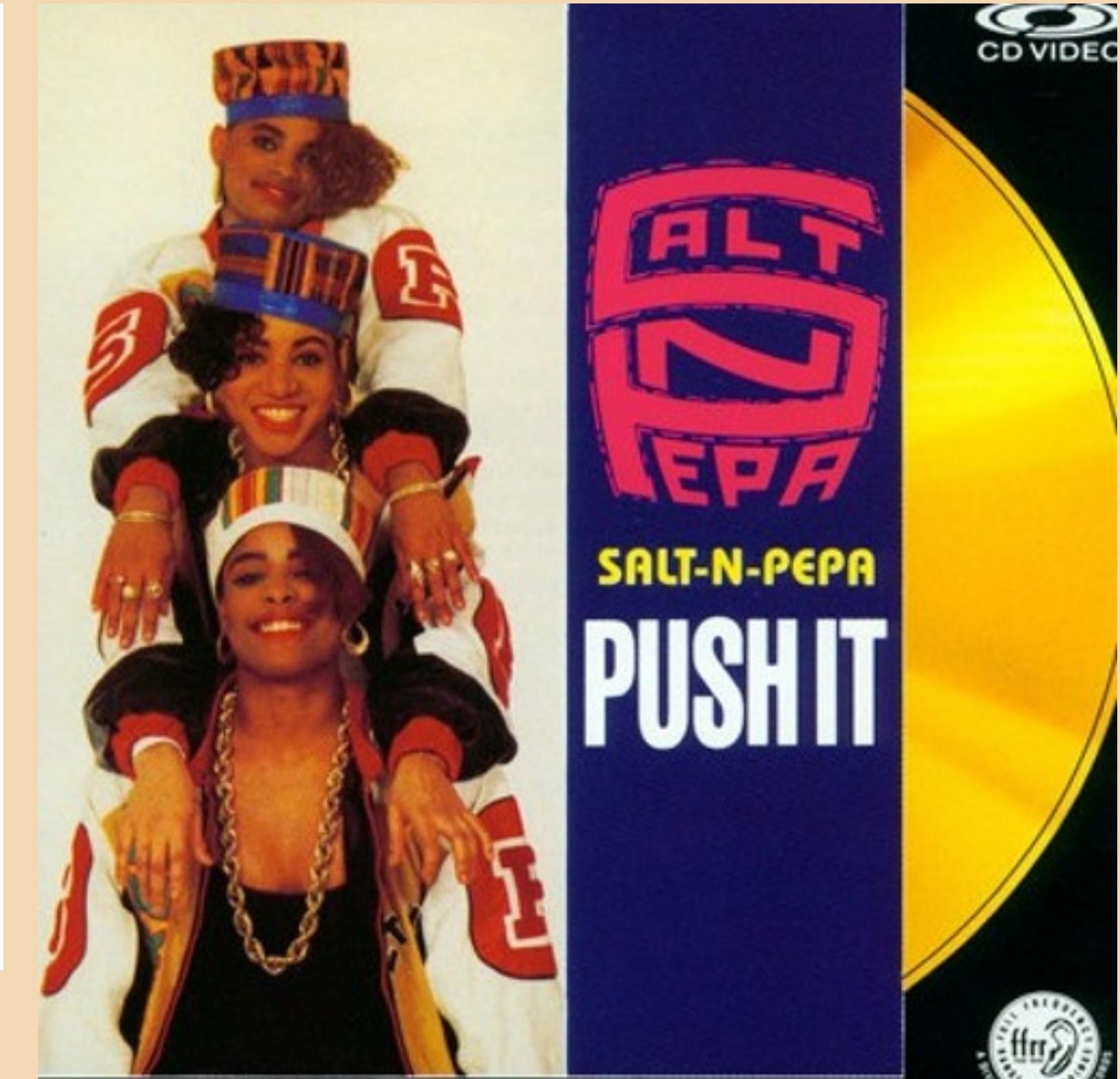


The guy she tells me not to worry about



OOH BABY BABY

WHY DOES GIT EXIST?



HOW MUCH TIME DO YOU WANT TO SPEND?



IS IT FINALS
WEEK AND
PRESENTATIONS
ALREADY?



GREAT
PROJECT



FANTASTIC
PROJECT



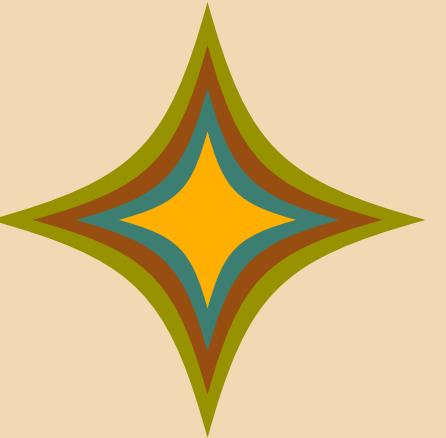
I HAVE NO LIFE BEYOND
THIS CLASS. I SLEEP IN
107E PAJAMAS. I DREAM
ONLY IN C. MY LIFE IS ON
HOLD FOR MY PI <3

MISC ALSO



- lab64 resources are available, feel free to ask liana! laser cutter, 3d printers, etc

- build off existing codebase
- ask for help with Makefiles
- code off the internet is a project in and of itself
- mechanical stuff is hard



QUESTIONS??



good luck with your
final projects!