At the end are the lecture notes for the three slides we didn't cover at oscon describing an application of flow.

Coding in the FLOW

Structuring your development environment to promote a state of flow

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tl;dw

1. Sprints/SCRUM/Rapid Development metholdology (GT)
2. Revision control with local and feature branches (G)
3. One click build system (F)
4. Test driven development (GF)
5. Tiered testing (unit, smoke, integration) (GFS)
6. Top-down/bottom-up (GS)
7. Defect tracking (GS)
8. Dashboards (FT)
9. Blameless workplace (T)
10. Shared vision (GT)

G = Clear, attainable goals
F = Immediate and relevant feedback
S = Matched Skill and Challenge
T = Team dynamics

WARNING: Cargo Culting flow won't really work.

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Outline

1. tl;dw
2. Consciousness
3. Intentions
4. Limits of Consciousness
5. Attention
6. Attributes of Flow
7. Prerequisites of Flow
8. Structuring for Flow

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[*citation needed*]

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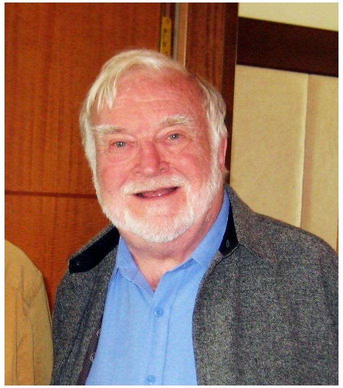
Flow: Definition

In positive psychology, **flow**, also known as **zone**, is the mental state of operation in which a person performing an activity is fully immersed in a feeling of energized focus, full involvement, and enjoyment in the process of the activity. In essence, flow is characterized by complete absorption in what one does.
– Mihaly Csikszentmihalyi



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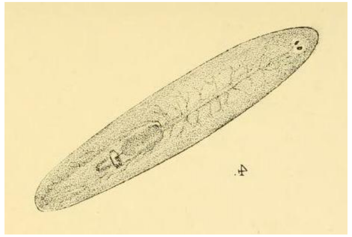
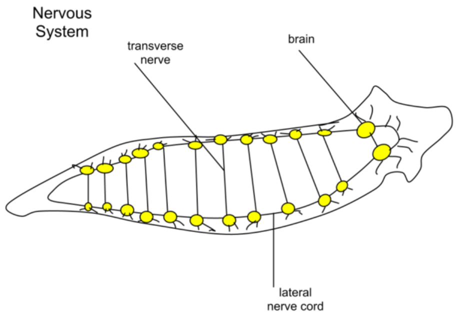
Consciousness

A human being should be able to change a diaper, plan an invasion, butcher a hog, conn a ship, design a building, write a sonnet, balance accounts, build a wall, set a bone, comfort the dying, take orders, give orders, cooperate, act alone, solve equations, analyze a new problem, pitch manure, program a computer, cook a tasty meal, fight efficiently, die gallantly. Specialization is for insects.

–Robert A. Heinlein





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Intentions

- Sensations and stimuli
- Processed by the consciousness
- Turned into potential actions
- Exogenic
- Endogenic
- Prioritized (continuously)
- Selected for action

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Limits of Consciousness

- Maximum of ~7 bits of concurrent information
- ‘bit’ varies by experience and subject matter
- Rate of recognition and change of bits 55ms
- Brain baud rate is therefore 126 bps
- Human speech recognition–40bps
- In a lifetime, 280Gbits of data
- Except
  - sleeping 20-35%
  - eating 8%
  - washing, dressing, toileting 8%

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Attention

- Generally your consciousness chooses what to ingest
- What you ingest is merged with your intentions
- Emotional response occurs when those conflict
- External events can trigger natural attention sinks
- Every moment gone by is a spent opportunity to maximize or squander your 126 bits of focus

“**Pay** Attention” means exactly that.

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The Self

- Consciousness exists
- Stimulus drives intentions
- Intentions are ranked by the consciousness
- Consciousness has finite capacity (126 bits/s of input)
- Our attention dictates inputs per the consciousness
- Therefore our consciousness dictates our mental state

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High Flow Activities

- Music
- Rock Climbing
- Dancing
- Sailing
- Chess
- Sports
- Reading
- We hope: Coding (← You are here.)

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Most Common Attributes of High Flow Activities

- Rules
- Goals
- Feedback
- Control
- Concentration
- Separation from Reality

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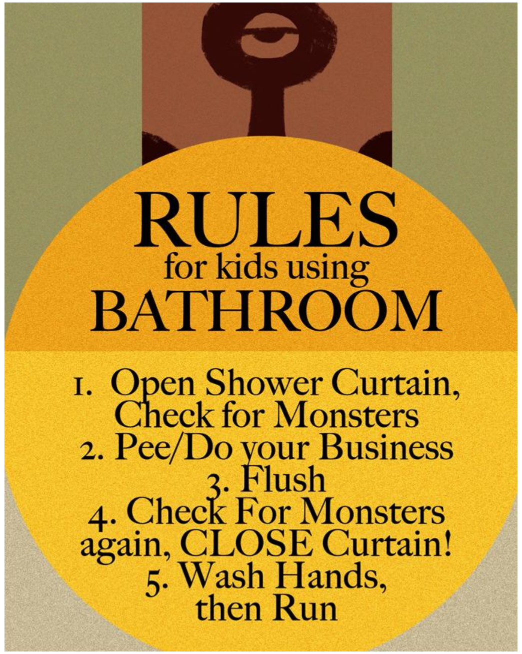
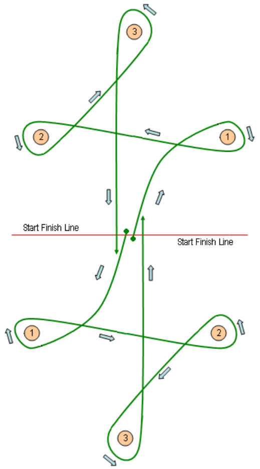
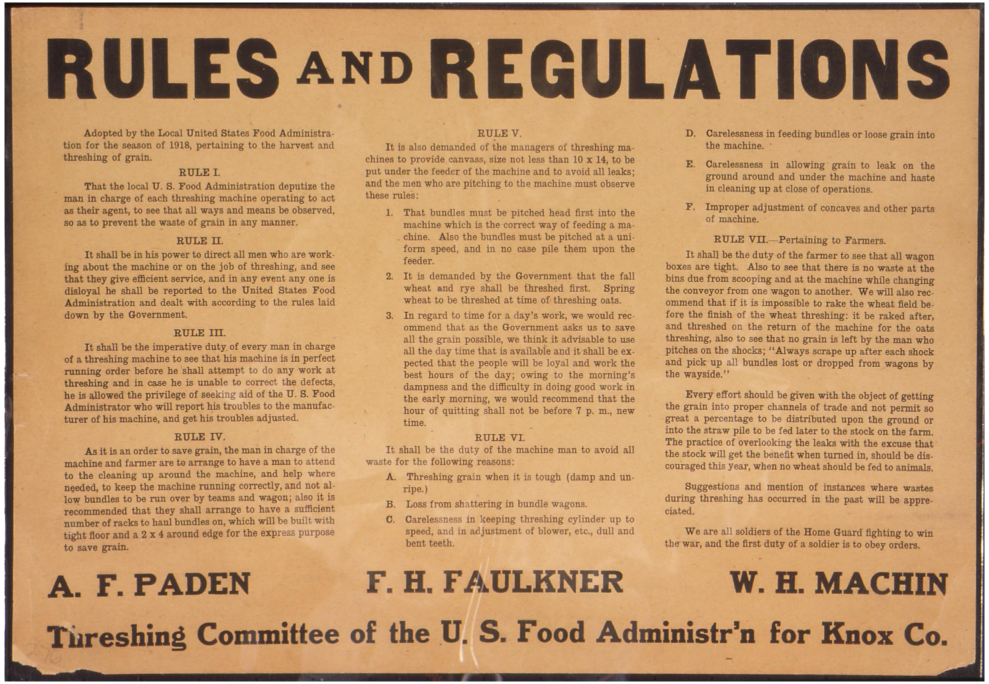
HFA Attributes: Rules



RULES
for kids using
BATHROOM

1. Open Shower Curtain, Check for Monsters
2. Pee/Do your Business
3. Flush
4. Check For Monsters again, CLOSE Curtain!
5. Wash Hands, then Run





RULES AND REGULATIONS

Adopted by the Local United States Food Administration for the season of 1918, pertaining to the harvest and threshing of grain.

RULE I.

That the local U. S. Food Administration deputize the man in charge of each threshing machine operating to act as their agent, to see that all ways and means be observed, so as to prevent the waste of grain in any manner.

RULE II.

It shall be in his power to direct all men who are working about the machine or on the job of threshing, and see that they give efficient service, and in any event any one is disloyal he shall be reported to the United States Food Administration and dealt with according to the rules laid down by the Government.

RULE III.

It shall be the imperative duty of every man in charge of a threshing machine to see that his machine is in perfect running order before he shall attempt to do any work at threshing and in case he is unable to correct the defects, he is allowed the privilege of seeking aid of the U. S. Food Administrator who will report his troubles to the manufacturer of his machine, and get his troubles adjusted.

RULE IV.

As it is an order to save grain, the man in charge of the machine and farmer are to arrange to have a man to attend to the cleaning up around the machine, and help where needed, to keep the machine running correctly, and not allow bundles to be run over by teams and wagon; also it is recommended that they shall arrange to have a sufficient number of racks to haul bundles on, which will be built with tight floor and a 2 x 4 around edge for the express purpose to save grain.

RULE V.

It is also demanded of the managers of threshing machines to provide canvass, size not less than 10 x 14, to be put under the feeder of the machine and to avoid all leaks; and the men who are pitching to the machine must observe these rules:

1. That bundles must be pitched head first into the machine which is the correct way of feeding a machine. Also the bundles must be pitched at a uniform speed, and in no case pile them upon the feeder.
2. It is demanded by the Government that the fall wheat and rye shall be threshed first. Spring wheat to be threshed at time of threshing oats.
3. In regard to time for a day's work, we would recommend that as the Government asks us to save all the grain possible, we think it advisable to use all the day time that is available and it shall be expected that the people will be loyal and work the best hours of the day; owing to the morning's dampness and the difficulty in doing good work in the early morning, we would recommend that the hour of quitting shall not be before 7 p. m., new time.

RULE VI.

It shall be the duty of the machine man to avoid all waste for the following reasons:

A. Threshing grain when it is tough (damp and unripe.)
B. Loss from shattering in bundle wagons.
C. Carelessness in keeping threshing cylinder up to speed, and in adjustment of blower, etc., dull and bent teeth.
D. Carelessness in feeding bundles or loose grain into the machine.
E. Carelessness in allowing grain to leak on the ground around and under the machine and haste in cleaning up at close of operations.
F. Improper adjustment of concaves and other parts of machine.

RULE VII.—Pertaining to Farmers.

It shall be the duty of the farmer to see that all wagon boxes are tight. Also to see that there is no waste at the bins due from scooping and at the machine while changing the conveyor from one wagon to another. We will also recommend that if it is impossible to rake the wheat field before the finish of the wheat threshing: it be raked after, and threshed on the return of the machine for the oats threshing, also to see that no grain is left by the man who pitches on the shocks; "Always scrape up after each shock and pick up all bundles lost or dropped from wagons by the wayside."

Every effort should be given with the object of getting the grain into proper channels of trade and not permit so great a percentage to be distributed upon the ground or into the straw pile to be fed later to the stock on the farm. The practice of overlooking the leaks with the excuse that the stock will get the benefit when turned in, should be discouraged this year, when no wheat should be fed to animals.

Suggestions and mention of instances where wastes during threshing has occurred in the past will be appreciated.

We are all soldiers of the Home Guard fighting to win the war, and the first duty of a soldier is to obey orders.

A. F. PADEN **F. H. FAULKNER** **W. H. MACHIN**

Threshing Committee of the U. S. Food Administr'n for Knox Co.

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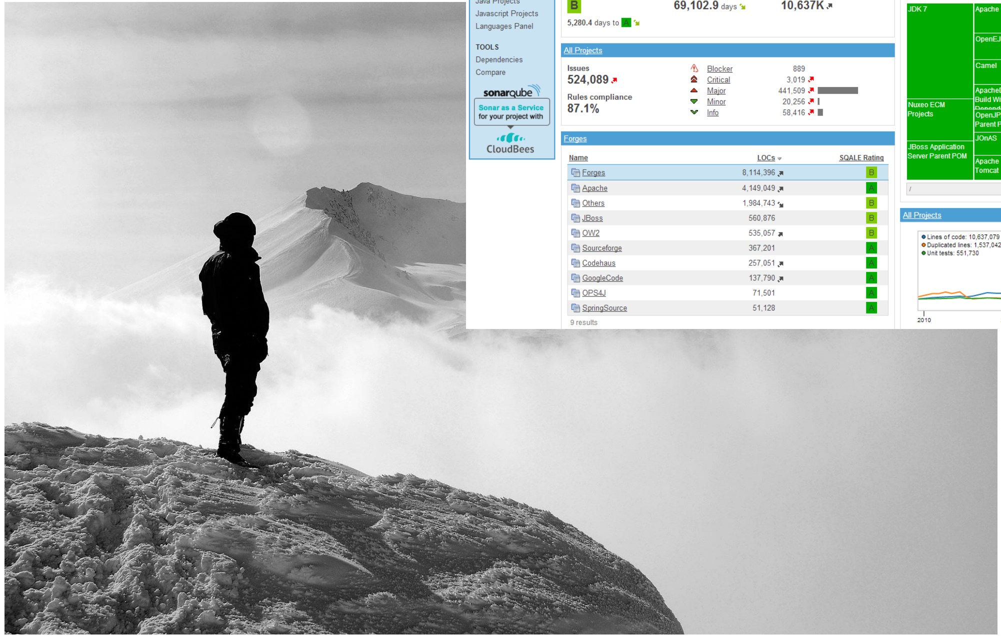
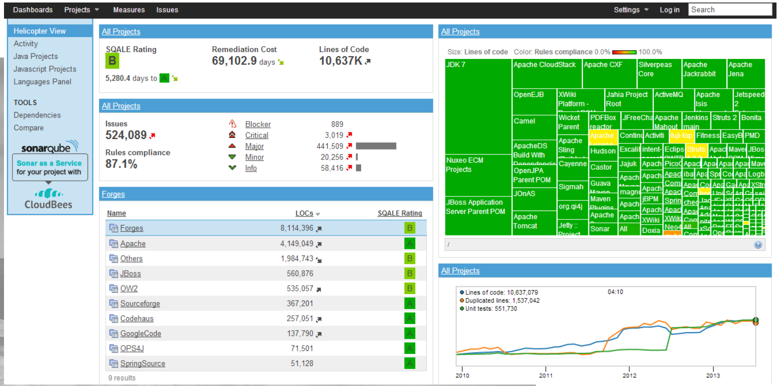
HFA Attributes: Goals





All Projects

SQALE Rating B
5,280.4 days to A

Remediation Cost
69,102.9 days

Lines of Code
10,637K

All Projects

Issues
524,089

Rules compliance
87.1%

Blocker	889
Critical	3,019
Major	441,509
Minor	20,256
Info	58,416

Forges

Name	LOCs	SQALE Rating
Forges	8,114,396	B
Apache	4,149,049	A
Others	1,984,743	B
JBoss	560,876	B
OW2	535,057	B
Sourceforge	367,201	A
Codehaus	257,051	A
GoogleCode	137,790	A
OPS4J	71,501	A
SpringSource	51,128	A

9 results

All Projects

Size: Lines of code Color: Rules compliance 0.0% 100.0%

All Projects

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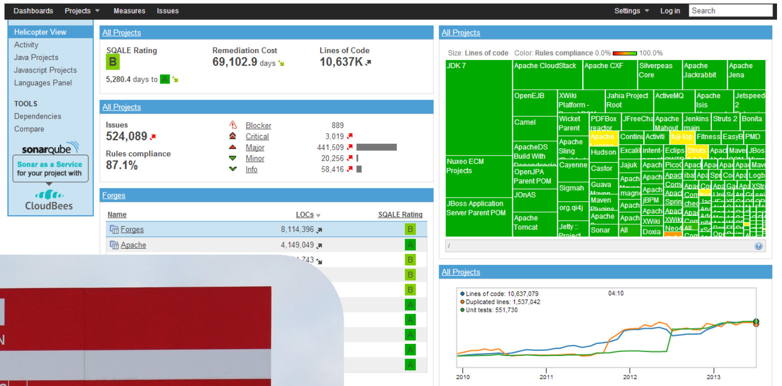
HFA Attributes: Feedback



All Projects

SQALE Rating	Remediation Cost	Lines of Code
B	69,102.9 days	10,637K
5,280.4 days to A		

All Projects

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Forges

Name	LOCs	SQALE Rating
Forges	8,114,396	B
Apache	4,149,049	A
	[illegible] 743	B

All Projects

Size: Lines of code Color: Rules compliance 0.0% 100.0%

All Projects

- Lines of code: 10,637,079
- Duplicated lines: 1,537,042
- Unit tests: 551,730

At Start	HOLE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	TOTAL
	PAR	4	4	4	3	4	5	3	4	4	4	4	3	4	3	5	4	5	5	
12	TSENG ★	12	12	11	12	12	13	13	12	12	11	11	11	11	11	11	11	11	11	277
8	HULL	8	9	10	9	9	9	9	8	8	8	9	9	10	10	10	10	10	10	278
6	KIM I	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	6	7	281
2	YANG A	1	1	1	2	2	2	2	2	3	2	2	2	3	3	4	5	5	6	282
4	SEO	4	4	4	3	3	4	5	5	5	5	4	4	5	5	5	5	5	6	282
4	UEDA	4	2	2	2	2	2	3	2	3	3	2	2	2	2	2	1	L	2	286
4	KIM C	4	3	3	3	3	3	3	3	3	1	1	1	L	1	2	2	2	2	286
4	PETTERSEN	4	4	4	4	4	4	4	3	3	4	3	3	2	1	1	1	1	1	287
4	KERR	4	5	5	5	5	5	5	5	6	6	6	5	5	5	6	6	6	6	282
3	CHOI N	3	2	2	3	3	4	4	5	5	6	5	5	5	5	4	4	5	7	281
4	PARK I	4	3	3	3	3	1	1	1	1	1	1	1	1	1	L	1	2	2	286
3	PRESSEL	3	4	4	3	3	3	4	4	4	5	4	4	3	4	3	3	3	4	284

HFA Attributes: Control

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HFA Attributes: Concentration

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HFA Attributes: Separation from Reality

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Three Prerequisites of Flow

- Clear Goals
- Immediate Feedback
- Matched Skill and Challenge

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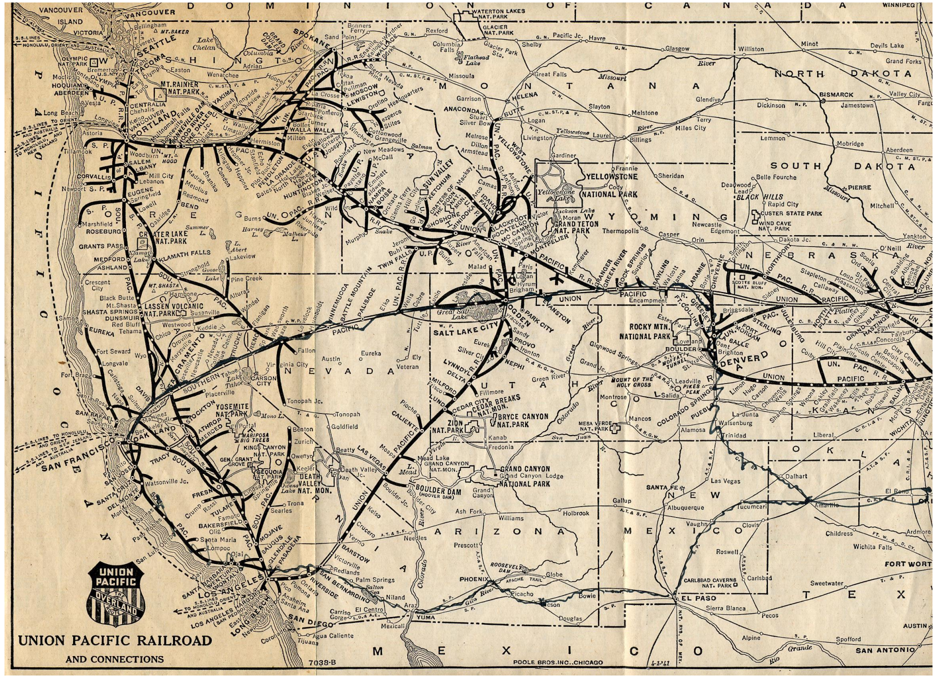
Clear Goals

You have to know where you are going

Knowing “Why?” helps too

Journey of 1000 miles



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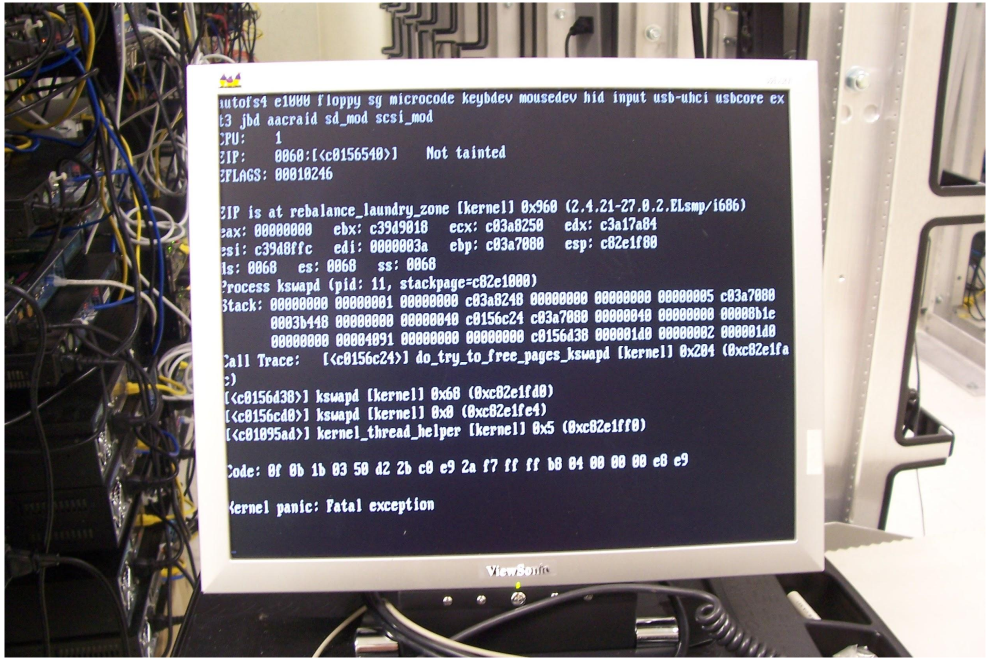
Immediate Feedback

Emphasis on **immediate**



```
autofs4 e1000 floppy sg microcode keybdev mousedev hid input usb-uhci usbcore ex
t3 jbd aacraid sd_mod scsi_mod
CPU:    1
EIP:    0060:[<c0156540>]    Not tainted
EFLAGS: 00010246

EIP is at rebalance_laundry_zone [kernel] 0x960 (2.4.21-27.0.2.ELsmp/i686)
eax: 00000000   ebx: c39d9018   ecx: c03a8250   edx: c3a17a84
esi: c39d8ffc   edi: 0000003a   ebp: c03a7080   esp: c82e1f80
ds: 0068   es: 0068   ss: 0068
Process kswapd (pid: 11, stackpage=c82e1000)
Stack: 00000000 00000001 00000000 c03a8248 00000000 00000000 00000005 c03a7080
       0003b448 00000000 00000040 c0156c24 c03a7080 00000040 00000000 00008b1e
       00000000 00004091 00000000 00000000 c0156d38 000001d0 00000002 000001d0
Call Trace:   [<c0156c24>] do_try_to_free_pages_kswapd [kernel] 0x204 (0xc82e1fa
c)
[<c0156d38>] kswapd [kernel] 0x68 (0xc82e1fd0)
[<c0156cd0>] kswapd [kernel] 0x0 (0xc82e1fe4)
[<c01095ad>] kernel_thread_helper [kernel] 0x5 (0xc82e1ff0)

Code: 0f 0b 1b 03 50 d2 2b c0 e9 2a f7 ff ff b8 04 00 00 00 e8 e9

Kernel panic: Fatal exception
```

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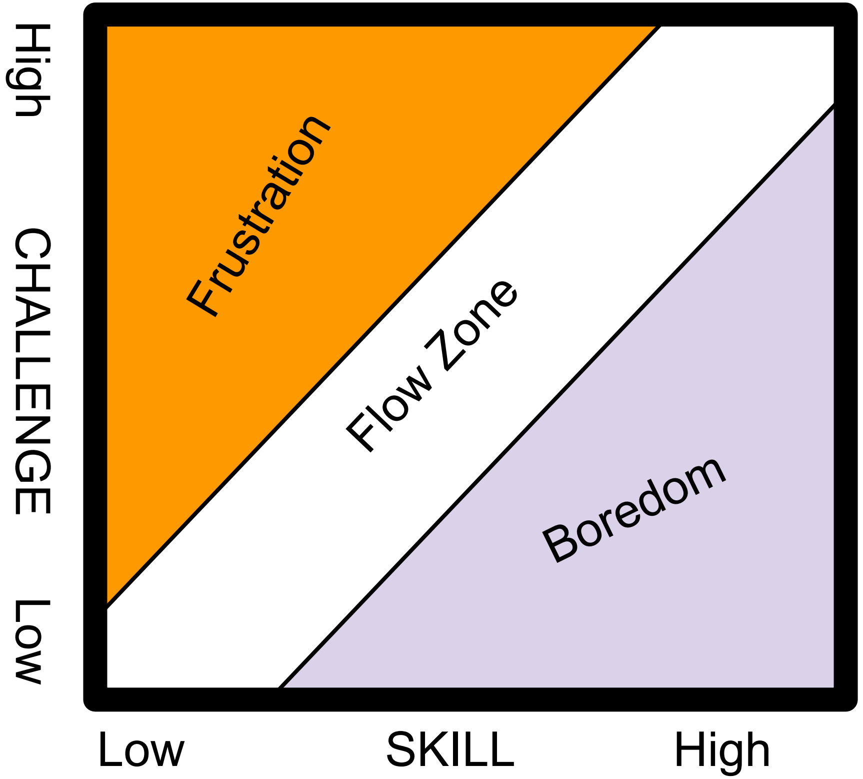
Matched Skill and Challenge



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Clear Goals

- Planned work, baby steps
  - SCRUM
  - Rapid Development
  - Agile
- Product Vision/Leadership
- Local Branches–Commit early and often (yay git!)
- Top-Down/Bottom-Up
- Test Driven Development
- Tiered Testing
  - Unit
  - Smoke
  - Integration
- Defect Tracking

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Immediate Feedback

- One click build system (F)
- Test driven development (GF)
- Tiered testing (unit, smoke, integration) (GFS)
- Dashboards (FT)
- Smart Tools (GF)

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Matched Skill and Challenge

- Sprints/SCRUM/Rapid Development metholdology (GT)
- Test driven development (GF)
- Tiered testing (unit, smoke, integration) (GFS)
- Top-down/bottom-up (GS)
- Defect tracking (GS)
- Blameless workplace (T)
- Codecraft

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Summary

Minimize **cognitive load** (126 bits per second)

Establish **Clear Goals** (final and intermediate)

Ensure **Immediate Feedback** (one click build+test, tools)

Match the **Skill to the Challenge** (increase if need be)

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FIN

Questions, Comments, Complaints, Hate mail:

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tl;dw

1. Sprints/SCRUM/Rapid Development metholdology (GT)
2. Revision control with local and feature branches (G)
3. One click build system (F)
4. Test driven development (GF)
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Extras

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Lecture notes for slide 23

There are lots of things that help us with our planning, but even detailed methods like daily standups probably are not narrow enough to be flow inducing.

- **fixing a single bug in your system**.
- sounds fine grained task
  - flow is about **short term** tactical gains.
  - Measured in hours, not days/weeks
- fixing the bug is the ultimate goal, but we need to measure progress!
- must, necessarily find finer steps, 2, 3, 10.

1) In my daily standup with my team, pick bug 339 as my main task for today.
   in concert with the overall team goal: stabilizing the next feature release
2) **Put on my headphones**
   a) **choose music that has a white noise effect dull my auditory senses**
   b) **enables me to focus**
   c) **avoid getting pulled into the discussions**
   d) Separation from reality
3) one-click build and run environment for this particular work session
   a) bookkeeping of creating a new git branch
   b) pulled from the appropriate code line or feature branch
   c) named for the task at hand with cross references into our bug tracking system
   d) resume flow if you go to lunch or get switched off to deal with something urgent
   e) enables rapid resumption with minimal cognitive
4) reproducible failing test case (TDD)
   a) unambiguously feedback on progress
   b) Usually several steps (nested processes)
      i) failure isn't easily testable
      ii) refactoring to surface the appropriate components.
5) Critical at each stage: local commit to my working branch
   a) 'refactored class X to make initial state externalizable'
   b) 'fixed the breakage I induced in the integration test when I messed up refactoring class X'
   c) 'added failing unit test for bug 339'
6) Now that I have an environment where I can hit F7 or whatever the appropriate key is, to begin actually solving the problem at hand.
7) work until the failing test case passes.
8) work until smoke tests pass
9) work until integration tests pass
10) Finally, I do the **merge** with the mainline branch after resolving all those wonderful merge conflicts.
11) Kick myself for not doing a merge after I refactored class X and before I started the bugfix

- Much is existing best practices
  - Applied with an eye toward satisfying the needs of flow
- Even I skip this workflow
  - Often regret it
  - annoyed at my task
  - 4 hours in
  - opened the code base
  - started making changes
  - discovered the class X refactoring
  - started doing that on top of my partial bugfix
  - broke the build horribly
  - can't unwind my bug fix code from my refactoring code
  - wish I had an intermediate checkpoint even an hour or two old
  - haven't passed a test in three hours, haven't successfully built in two
  - burn it down, start again
- Also, Checklist Manifesto, read it.
  - Discipline is hard, humans are bad at it

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Lecture notes for slide 24

In that discussion about fixing a bug, when I did it the right way, I set up a system where I would get immediate feedback as to whether or not the problem had been fixed or not, including building parts of the system I would need in the refactoring.

Each step of the way all I needed to do was hit F7 (or whatever your dev environment equivalent is) and it would kick off a build + run of the relevant **unit** tests showing a big green or big red box. Bam, immediate feedback. Unit tests, not integration tests because they run faster (a few seconds at most).

- Even better, for some languages my IDE catches typos for me automatically and underlines them
  - Immediate feedback.
- For other languages, it tells me when I've forgotten to initialize a variable
  - Immediate feedback.
- For other languages, my editor automatically navigates me to the line and character of compiler errors while highlighting the error message in a contrasting color so I can continue working
  - Immediate feedback.
- Sadly for others, I have no type information or even required variable declarations and so I have no idea if my code really works until a full integration test. Very slow feedback. Given I'm very weak at writing code in this language, I often regret and put off projects that require it because I subjectively hate the lack of control I feel.

The polar opposite of this kind of immediate feedback is card based batch computing where your feedback loop is handing a program deck over to an operator, waiting an hour (or a week) and getting back your output deck or just a printout of the core dump.

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Lecture Notes for Slide 25

In this area, it mostly comes down to choosing what to work on and, more importantly, choosing HOW to work on it.

- Learning a new system
  - Get it to compile
  - Get it to not crash
  - Get it to pass a trivial unit test
- Multi year wrestling match with Go

- Other languages where I have a couple decades experience
  - Mental effort goes to meta activities
    - clean code structure
    - readability
    - maintainability
    - testability
  - These reduce cognitive load of ongoing work
- Go look at your really old code
  - Try not to cry; cry a lot
  - By the standards at the time, you were doing well
- Enlightened teams
  - actively structure tasks, avoid all urgent work going to fastest/most experienced
  - manage work to promote zone and growth
- Individual contributor
  - Examine your tasks
  - Find ways to adjust the skill level up for the mundane/boring work
  - Focus on your craft, the skill
  - Drudgery always exists (Boredom zone)
  - At the meta, don't do the drudgery, eliminate it entirely, automate it, write a tool, eliminate the need
    - Adjust your subjective experience and intent
- Proactively decide what kind of work you have and what sort of work you will do. Avoid boredom at all costs.

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