

Guiding Principles for Research/Product Engineering

Vyas Sekar

Pop Quiz: Do you know these eminent gentlemen?

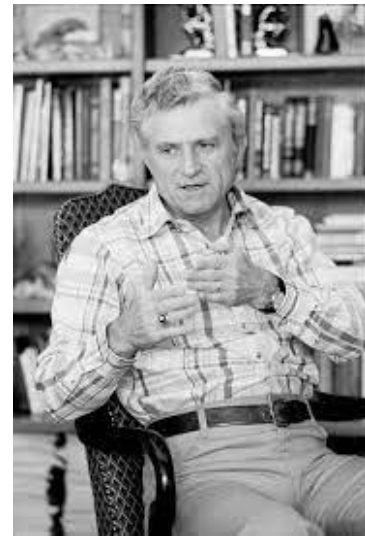


Pop Quiz: Do you know these eminent gentlemen?

George Heilmeier



George Polya



Gene Amdahl



Herbert Simon

Part 1: Heilmeier Catechism

George Heilmeier



Heilmeier's Questions

- What are you trying to do? Articulate your objectives using absolutely no jargon.
- How is it done today, and what are the limits of current practice?
- What is new in your approach and why do you think it will be successful?
- Who cares? If you are successful, what difference will it make?
- What are the risks?
- How much will it cost?
- How long will it take?
- What are the mid-term and final “exams” to check for success?

Part 1: Heilmeier Key Takeaways

- Before embarking on a research project ask the Heilmeier questions
- Periodically revisit
- Pivot if evidence suggests otherwise!

Part 2: Amdahl's Law

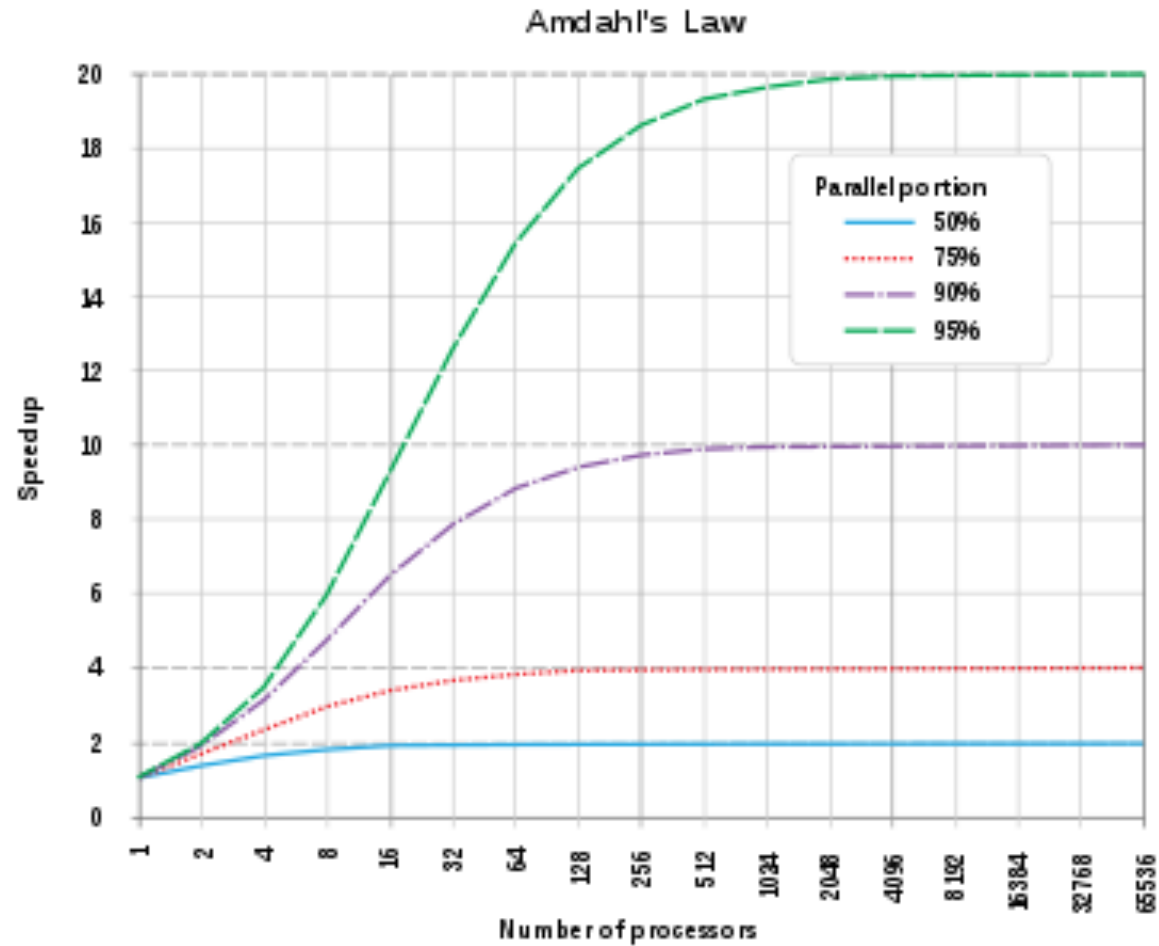


Gene Amdahl

Amdahl's Law

"the overall performance improvement gained by optimizing a single part of a system is limited by the fraction of time that the improved part is actually used"

Amdahl's Law, Visually



Implications of the law: Make Profiling A Must

To find the places where time is being spent in a large system, it is necessary to have measurement tools that will pinpoint the time-consuming code. Few systems are well enough understood to be properly tuned without such tools; it is normal for 80% of the time to be spent in 20% of the code, but a priori analysis or intuition usually can't find the 20% with any certainty.

Hints for Computer System Design,

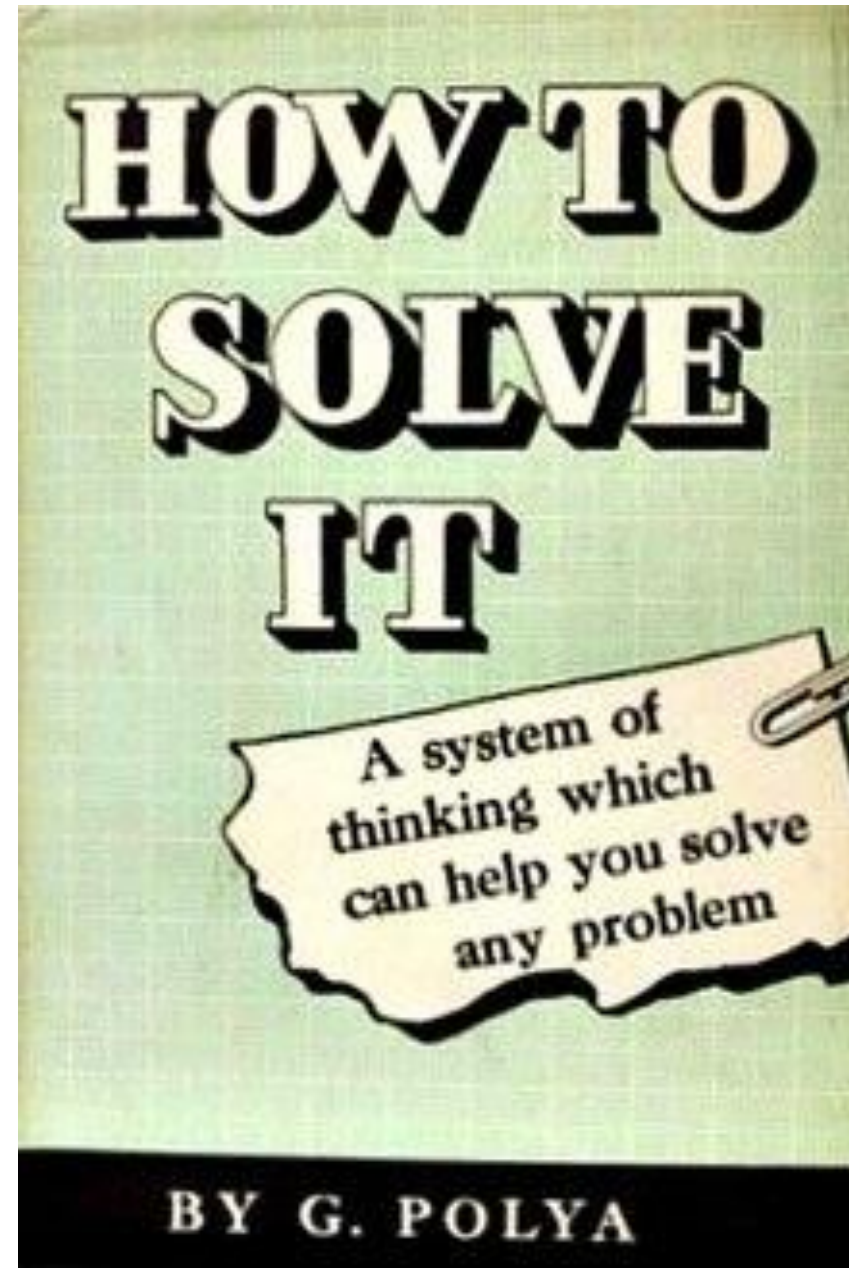
Butler Lampson

Part 3: How to Solve It

George Polya



Must read



Four step approach

1.First, you have to *understand the problem*.

2.After understanding, *make a plan*.

3.*Carry out the plan*.

4.*Look back* on your work. How could it be better?

Understand the problem

- What are you asked to find or show?
- Can you restate the problem in your own words?
- Can you think of a picture or a diagram that might help you understand the problem?
- Is there enough information to enable you to find a solution?
- Do you understand all the words used in stating the problem?
- Do you need to ask a question to get the answer?

Devise a Plan of Attack

Heuristic	Informal Description
Analogy	Can you find a problem analogous to your problem and solve that?
Auxiliary Elements	Can you add some new element to your problem to get closer to a solution?
Generalization	Can you find a problem more general than your problem?
Induction	Can you solve your problem by deriving a generalization from some examples?
Variation of the Problem	Can you vary or change your problem to create a new problem (or set of problems) whose solution(s) will help you solve your original problem?
Auxiliary Problem	Can you find a subproblem or side problem whose solution will help you solve your problem?
Here is a problem related to yours and solved before	Can you find a problem related to yours that has already been solved and use that to solve your problem?
Specialization	Can you find a problem more specialized?
Decomposing and Recombining	Can you decompose the problem and "recombine its elements in some new manner"?
Working backward	Can you start with the goal and work backwards to something you already know?
Draw a Figure	Can you draw a picture of the problem?

Carry out the Plan

- Persist with the plan that you have chosen.
- If it continues not to work, discard it and choose another.
 - Fail Early 😊

Review/Extend

- Reflect
- Post Mortem
- Find opportunities to improve

Part 4: Attention Economics



Herbert Simon

In the words of Simon

In an information-rich world, the wealth of information means a dearth of something else: a scarcity of whatever it is that information consumes.

What information consumes is rather obvious: it consumes the attention of its recipients.

Hence a wealth of information creates a poverty of attention and a need to allocate that attention efficiently among the overabundance of information sources that might consume it

Exercise

- Code?
- Slides
- Emails ?
- Meetings?

*“I didn't have time to write a short letter,
so I wrote a long one instead.” – Mark Twain*

Putting it together: Process

George Heilmeier



Articulate
the
Goals

Gene Amdahl



Identify the
“elephant”
in the room

George Polya

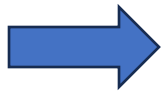


Formulate,
Solve,
Refine

Herbert Simon



Articulate
The
Idea!



Takeaways/ Recommendations

- Heilmeier: For any new/current project write a Heilmeier doc
- Amdahl: For any process/performance/bottleneck, apply profiling, focus on high order bits and big wins
- Polya: Formulate, Refactor, Visualize problems in Input/Output
- Simon: Empathy for your audience's attention

How to make compelling Demos!

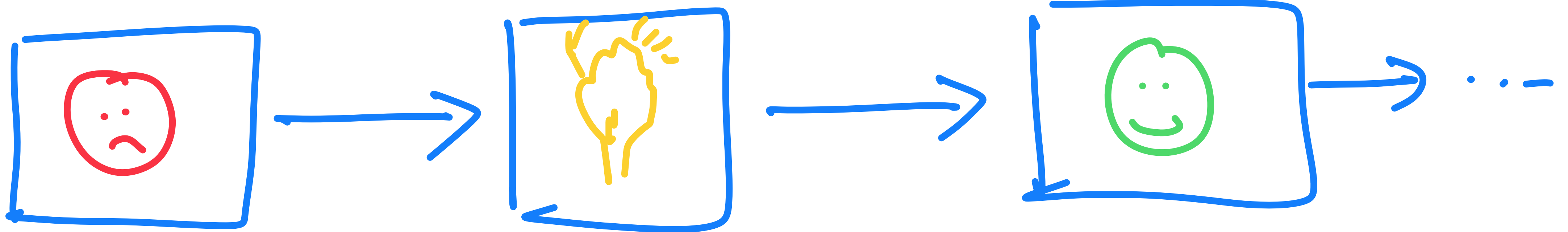
Uyas Sekar

Start with a Story Board

use powerpoint to make a story ✗

start with "our platform" ✗

Use a whiteboard / pen & paper to draft



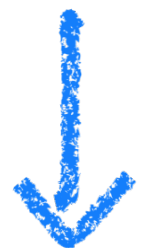
Why white board / paper?

Powerpoint / Platforms are terrible mediums

⇒ Engender Complexity

White board /

Paper



"painful to write"



Forces "parsimony"
Distill essence of story

Less noise

No wall of text / simple visuals.

Cardinal Sin of Demo / Presentation
: Verbosity, clutter, overload.

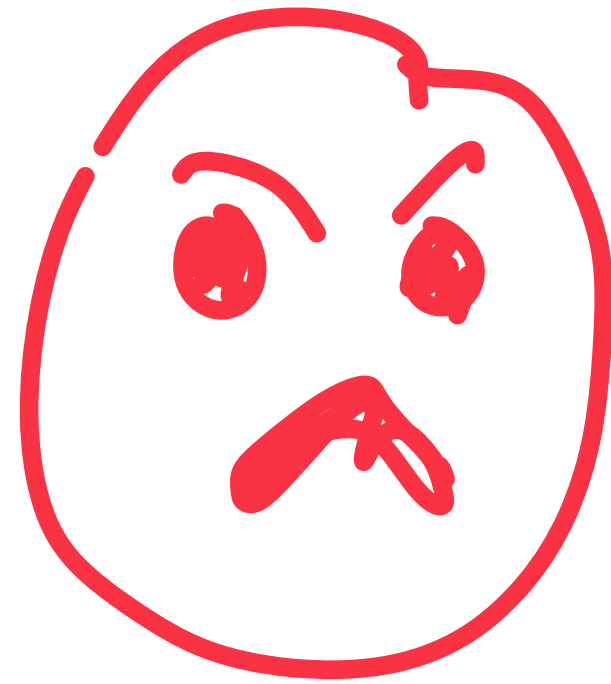
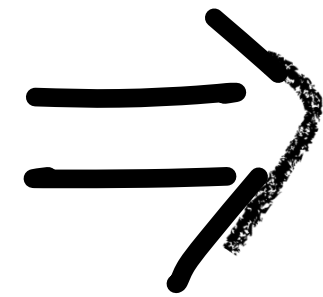
"I didn't have time to write a short letter
so I wrote a long one instead"
- Mark Twain.

Demo story Template

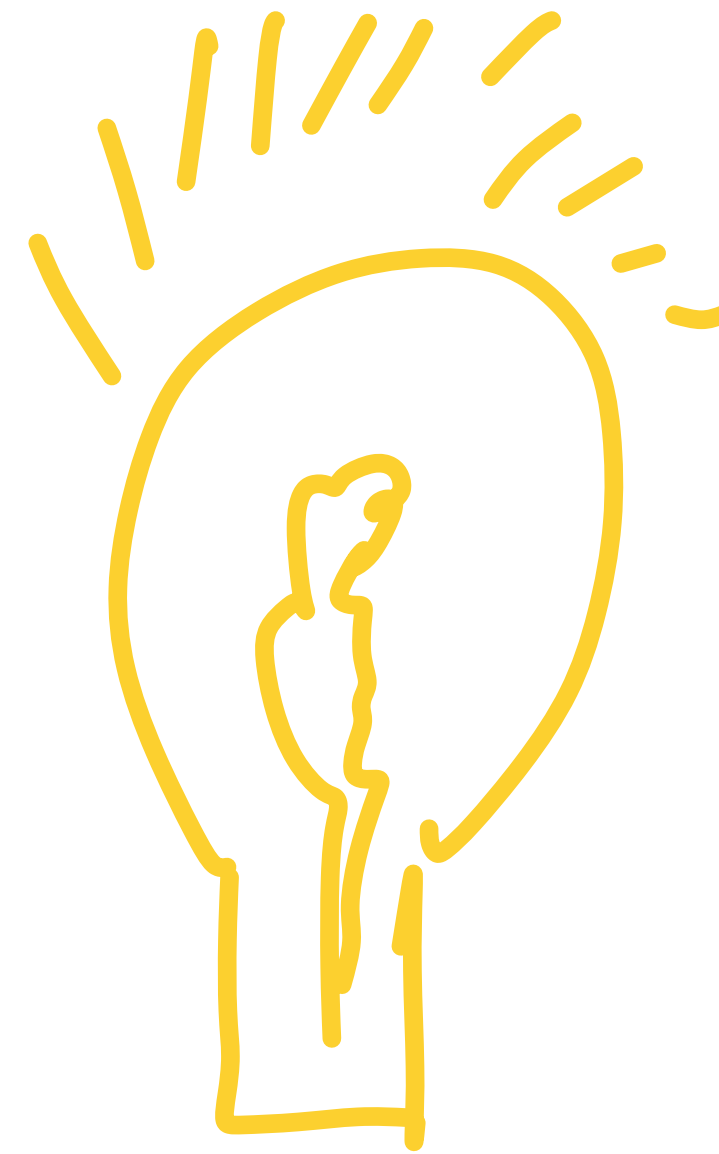
PAIN POINTS



User hair
on fire

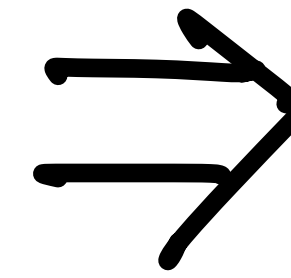


WTF
frustration
with status quo



aha
moment

SOLUTION



happy
user !

Let us try an interactive exercise



What is pain point for our user?

Who is our user?

Who is in the audience?

Effective
focus on user pain

Customized, understand
user

Specific - 1 - less is
more.
tell a "story"

Ineffective

focus on our tool

generic user scenario

not relevant to customer.

laundry list of scenarios

jump into details

— Customize Pain / frustration story .



eg - M & E $\Rightarrow$.

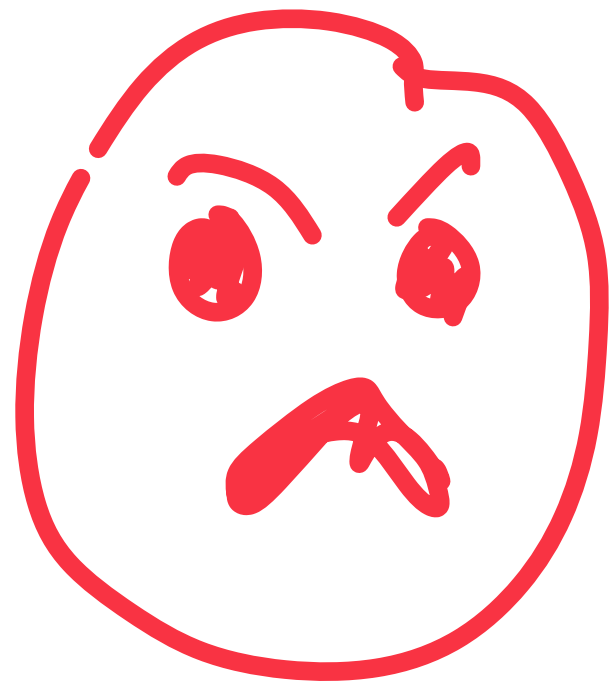


— fintech

— retail app :



Pick a scenario
that resonates
for them, not
what's easy for
us !!



WTF

frustration
with status quo

What are they using today?

What's broken?

Why don't they like it?

Effective

Pick concrete examples
ideally know customer's
deployment

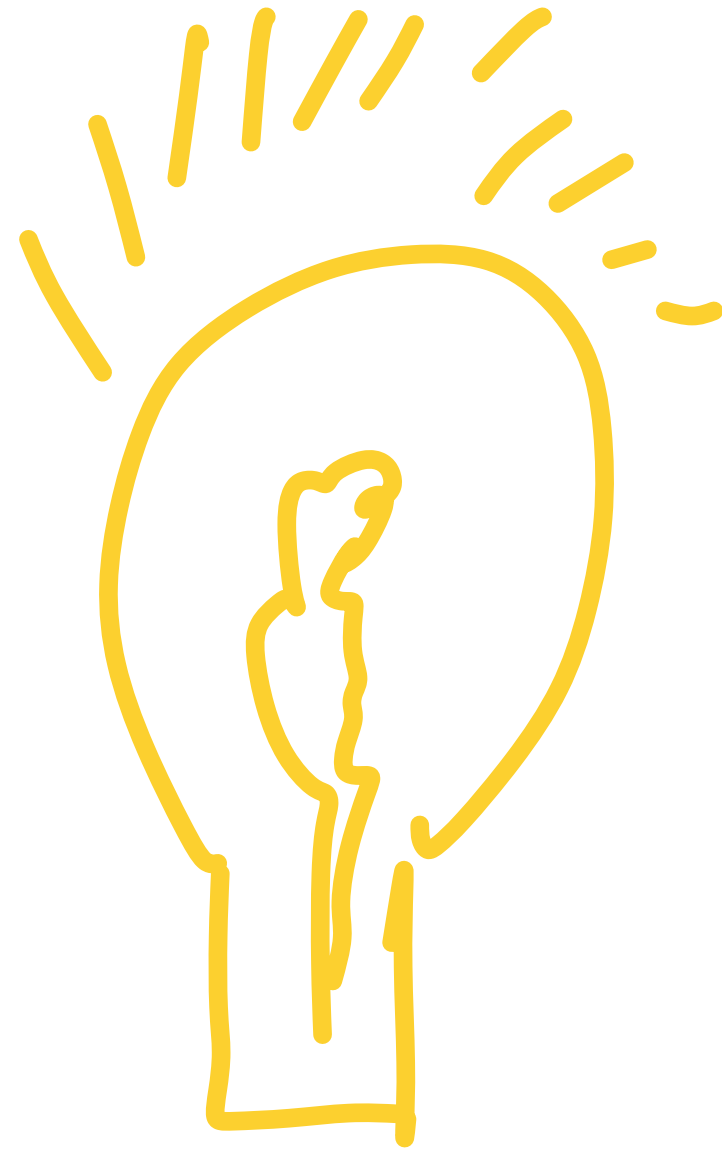
"High order bit"
what's broken,
not laundry list

Ineffective

← Avoid talking about current
tools

Mentioning a lot of low
level details on current
tools

← Spend too much time



aha
moment

What is our USP

What is our silver bullet

Why will this be game changer?

↳ cost?

effort?

accuracy?

Effective

Focus on 1-2
compelling bts

30 seconds - cut to
USP!



Ineffective

D D D D D D D D

show many features

long demo





happy
user !

how do we show how they
will be happier using
our product ?

Effective.

Visually obvious
1-2 pts max

Keep it simple!

Ineffective

show every cool
thing we have

multiple
nuances

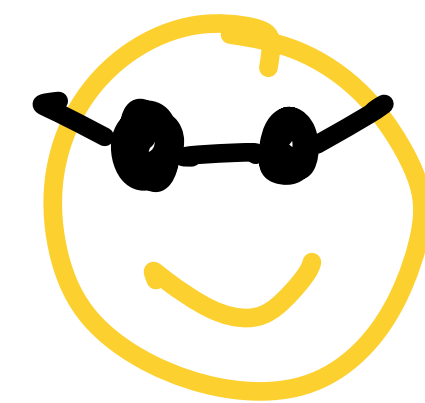
A large, hand-drawn red arrow starts at the top left and points diagonally down and to the right, following the curve of the text 'multiple nuances'. It is composed of several connected segments, giving it a fluid, hand-drawn appearance.

BONUS

Making Effective Slides:

Focus on "Hero", "Declutter", "Hero in Title"

Every slide has 1 Hero
that message is in title



= Message

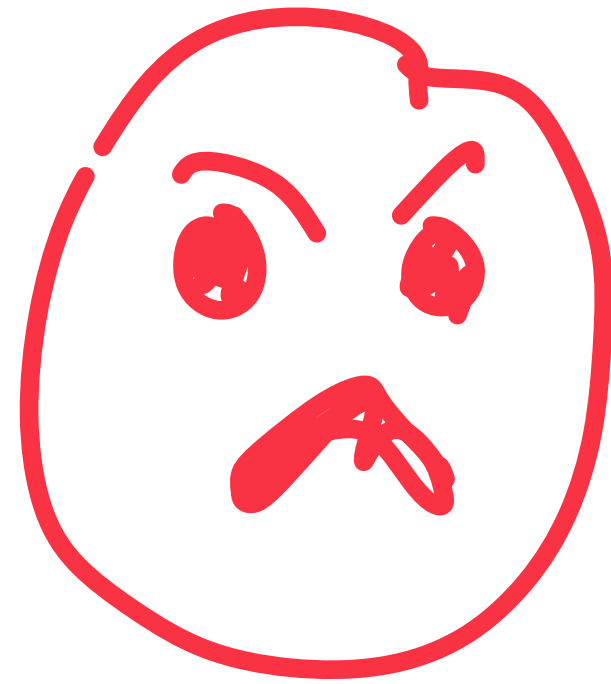
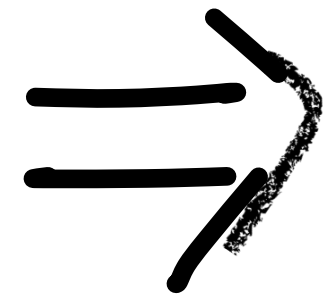
Draw slide on
white board
first!

Demo story Template

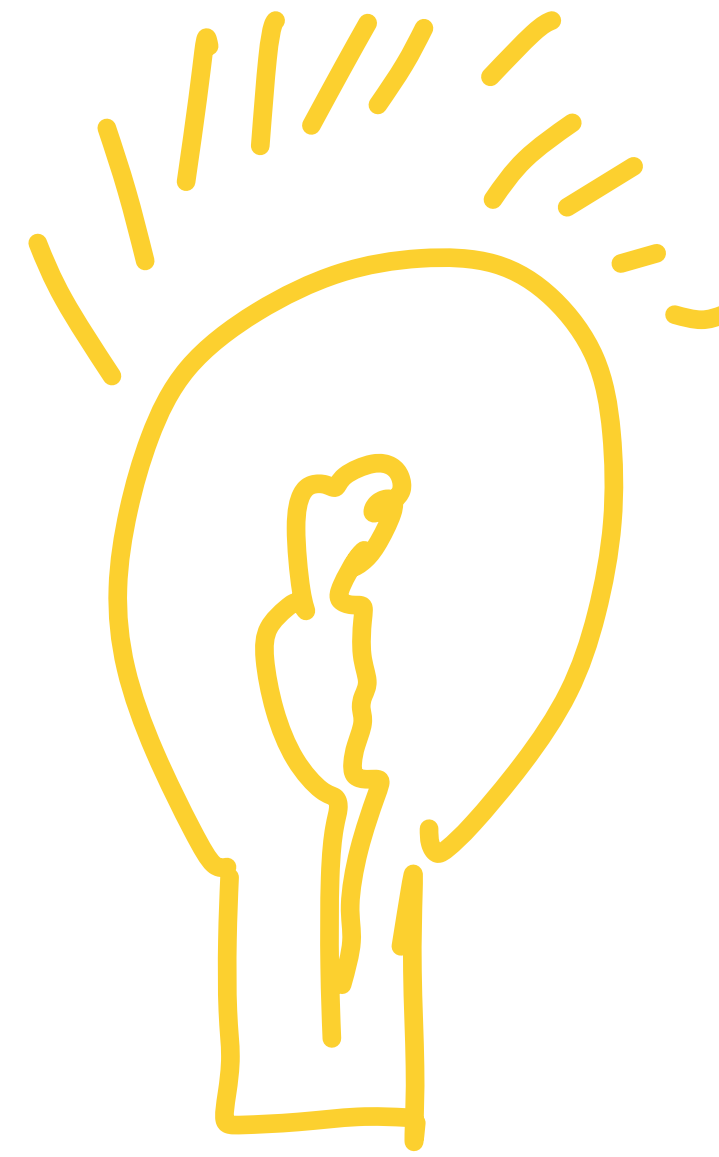
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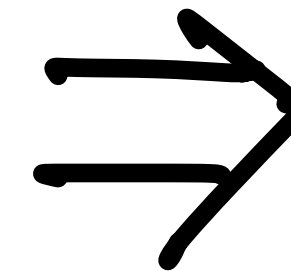


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frustration
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aha
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SOLUTION



happy
user !

Homework 😊