Safe tysyn thesis

Human Factors & System Safety

"People in Control"

Human Factors – as "Done"

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What should the role of HF be?

The inner view
(Work-as-Imagined)

- Workload
- Decision making
- Situation awareness
- Compliance to rules

The outer view
(Work-as-Done)

- Staying in control?
- Changing demands and resources?
- Working across boundaries?
- Continuous adjustments?

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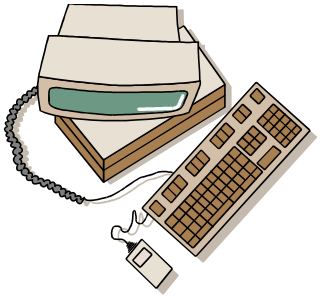
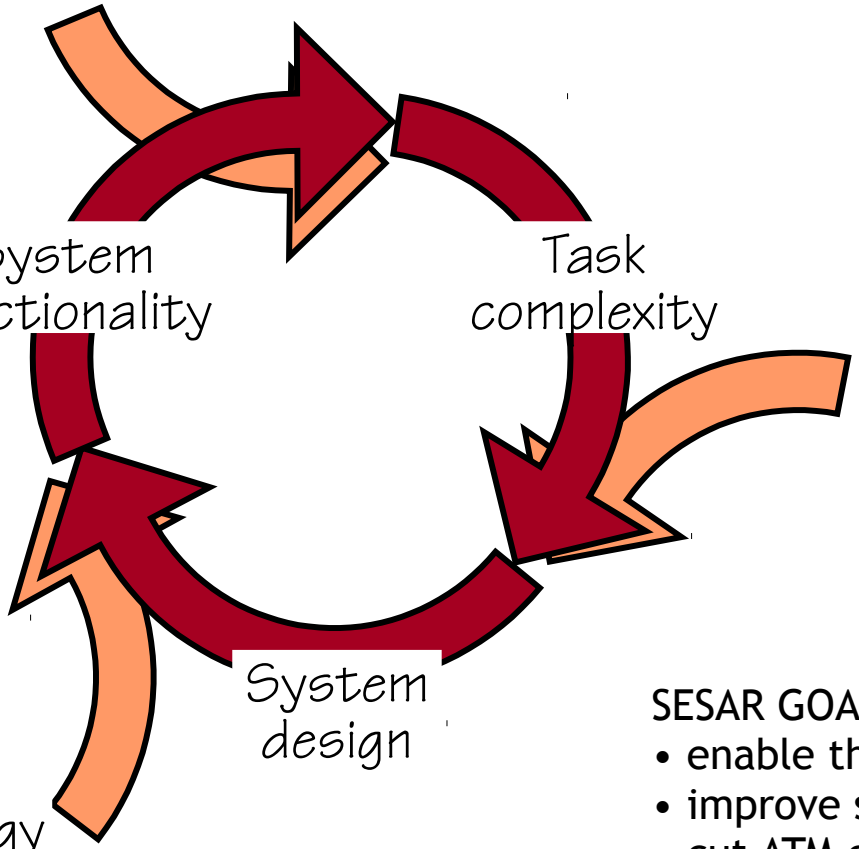
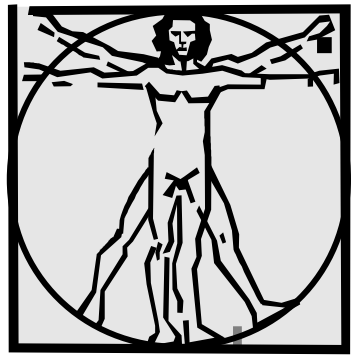
Unstoppable optimism

Performance demands

Better Faster Cheaper







Human characteristics (finite capacity)

SESAR GOALS FOR 2020

- enable threefold increase in capacity
- improve safety by a factor of 10
- cut ATM costs by half
- reduce environmental impact by 10%

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The reality of work

Actual working conditions (people, time, information, equipment, etc.) are never as imagined.

People adjust what they do to match the situation.

Performance variability is inevitable, ubiquitous, and necessary.

Because of resource limitations, performance adjustments will always be approximate.

Performance adjustments are the reason why work is safe and effective.

Performance adjustments are the reason why things sometimes go wrong.

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Work as imagined – work as done

Work-as-Imagined (WAI) is what designers, managers, and authorities assume happens or should happen.

Work-as-Imagined (WAI) is the basis for design, training, and planning (safety and production).

Work-as-Done (WAD) is what actually happens.

Work-as-Done (WAD) is what people have to do to cope with the complexity of the actual work environment.

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The need to "imagine" how others work

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Design (tools, roles, environment)

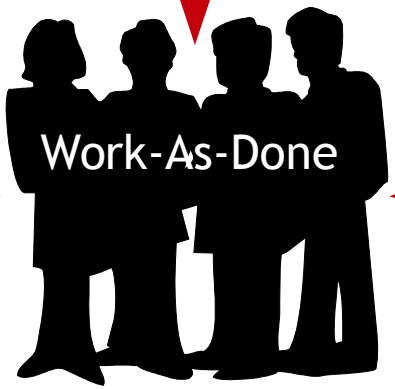
Work-As-Imagined

Work & production planning ("lean" - optimisation)

Work-As-Imagined

Safety management, investigations & auditing

Work-As-Imagined



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Designing for work-as-imagined

Designer(s)

What support do people need?

How should it be provided?

How will it fit existing ways of working?

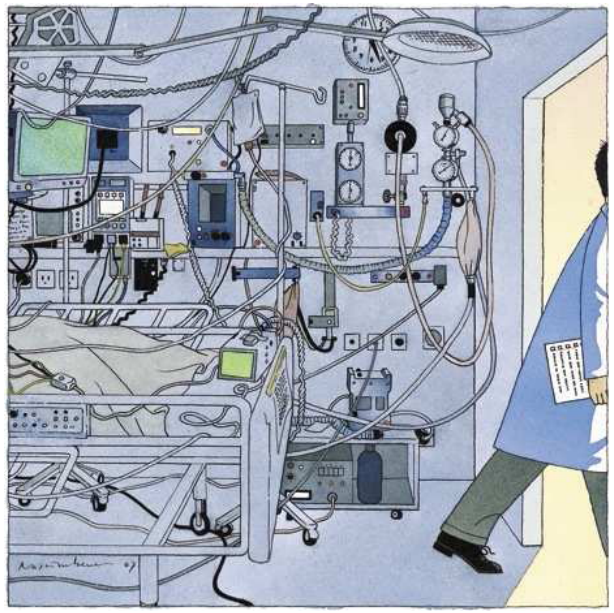
How should it be used correctly?

What have they been thinking of?

What is this supposed to do?

Why does it not fit the way we work?

How can we get it to work?



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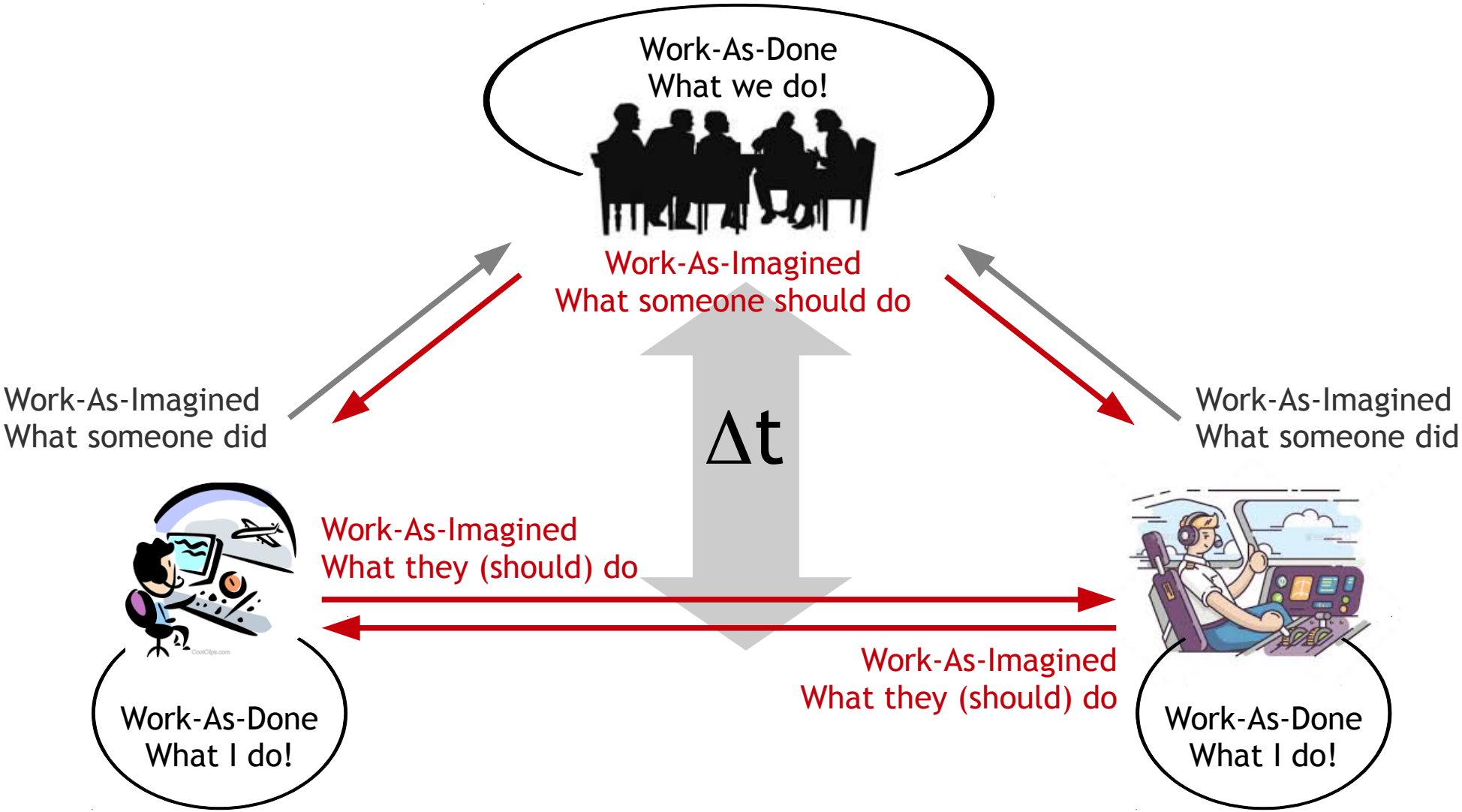
We all have to think about work



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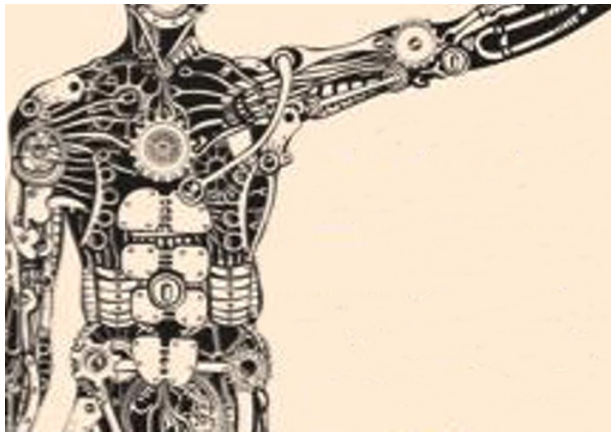
What should HF refer to?

The polished view (WAI)

Models, theories, hypotheses, social constructs, myths, ...



The nitty-gritty (WAD)

Observations (“facts”), evidence, patterns, assumptions, heuristics

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I: Trade-offs are inevitable

There is rarely the time, the information, the means, or the energy to consider every detail and every aspect of what we are about to do. We tend to reason by analogy and to rely on simplifying assumptions – at the sharp end and the blunt end alike.

The most common trade-off is between efficiency and thoroughness. Trade-offs in daily work are usually due to trade-offs made in the design of artefacts and specification of working procedures.

Trade-offs in decision making:

* Heuristics in judgement and decision making (Tversky & Kahneman, 1974),
* Satisficing (Simon, 1956)
* 'Muddling through' (Lindblom, 1959)
* Recogniion-primed decisions (Klein, 1998).

Trade-offs and workarounds are an unavoidable part of Work-as-Done and are furthermore indispensable.
Classical HF have tried to prevent or overcome them. Instead we should try to understand them better, and to facilitate because they are beneficial rather than harmful the majority of cases.

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Efficiency-Thoroughness Trade-Off

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Thoroughness: Time to think

Recognising situation.
Choosing and planning.

If thoroughness dominates, there may be too little time to carry out the actions.

Neglect pending actions
Miss new events

Time & resources needed

Time & resources available

Efficiency: Time to do

Implementing plans.
Executing actions.

If efficiency dominates, actions may be badly prepared or wrong

Miss pre-conditions
Look for expected results

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II: Avoid unnecessary efforts

The design of tools, work, and interfaces should allow work to be done without unnecessary effort.
Simple things should be simple to do.

Examples:

The use of tools/equipment should not introduce any unnecessary delays.
The use of tools/equipment should be obvious, so people can focus on their tasks.
Task descriptions and task sequences should be short.
Limit the number of actions in a sequence to a minimum.
Break up long task sequences into sub-sequences.
Avoid the need to do two complex tasks together.
Action sequences for different tasks should be unique.

What is needed should be simple to do	What is risky should be difficult to do	What is forbidden should be impossible to do

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Avoid unnecessary efforts

It should be simple to find the right change.

It should be simple to use a mobile phone.

It should be simple to pay for your parking or buy a train ticket.

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III: Match form and function

The physical appearance of an artefact should match its use.
This applies to physical qualities such as size, shape, grip, colour, etc., as well as to how it functions and how it is controlled.

A hammer can differ in size, weight and shape depending on its purpose.

A steering wheel can differ depending on the kind of car and driving.

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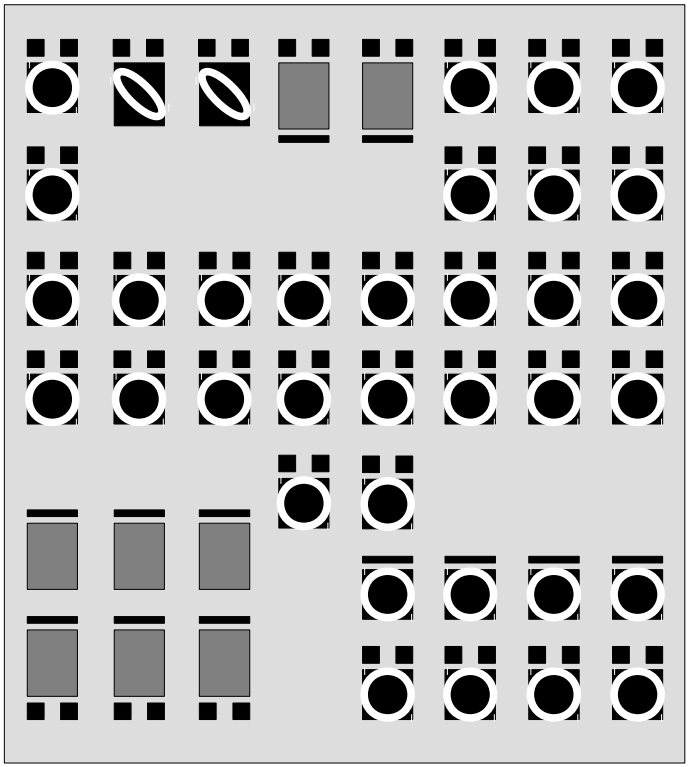
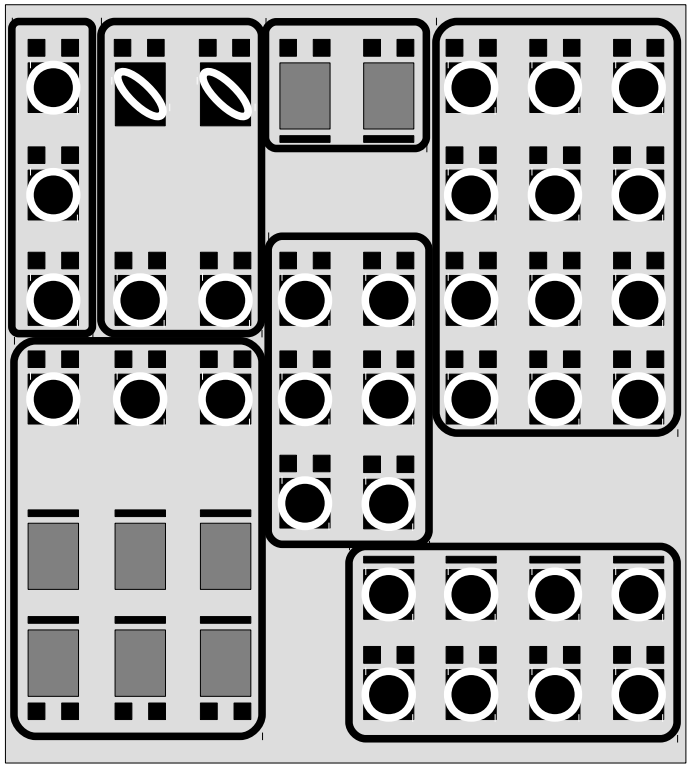
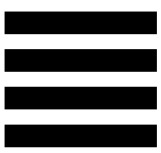
Match form and function – be smart

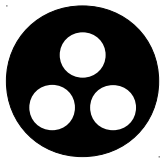
Post-TMI:
"Paint, tape, and label",
was used to group
control functions and
identify functional
relationships.

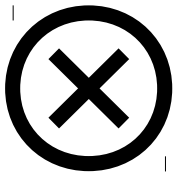




What do these icons mean?







'Reorder'
'Group work'
'Highlight remove'

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IV: What You Look For Is What You See

"What-is-there-is-what-you-see". The brain is a passive receiver of information that notices everything that happens around.

'What-you-look-for-is-what-you-see'. The brain actively selects information according the current understanding of the situation – we see what we expect to see.

THE COLOUR CHANGING CARD TRICK

Corollary: "What-you-see-is-what-you-do".

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The invisible gorilla

Psychological Science
24(9) 1848–1853
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The Invisible Gorilla Strikes Again: Sustained Inattentional Blindness in Expert Observers

We asked 24 radiologists to perform a familiar lung-nodule detection task. A gorilla, 48 times the size of the average nodule, was inserted in the last case that was presented. Eighty-three percent of the radiologists did not see the gorilla. Eye tracking revealed that the majority of those who missed the gorilla looked directly at its location. Thus, even expert searchers, operating in their domain of expertise, are vulnerable to inattentional blindness.

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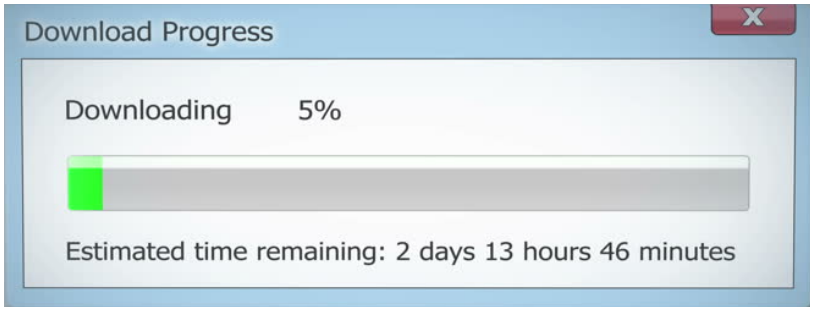
V: Show what happens (feedback)

In order to manage or control an ongoing activity, it is necessary to know what is happening – it is necessary to provide feedback.

Feedback can show how fast something is happening.



Control is easily lost if feedback is delayed or missing.

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When views collide …

WAI ≠ WAD

WAI ≠ WAD

Solution: Make sure that WAD is more like WAI.

Tempting because WAI seems to be clear and well-defined, and it is easier to prescribe that WAD should be changed than to change WAI.

WAI ≠ WAD

Solution: Adjust WAI to be more like WAD.

Difficult because WAD appears to be unclear and difficult to grasp, because WAD is forever changing, and because it will threaten those in charge.

WAI ≠ WAD

Solution: Realign WAI and WAD.

To change WAI: Get information about WAD faster. Improve quality of information about WAD (Safety-II).

To change WAD: Encourage mindfulness. Make informal communication easier.

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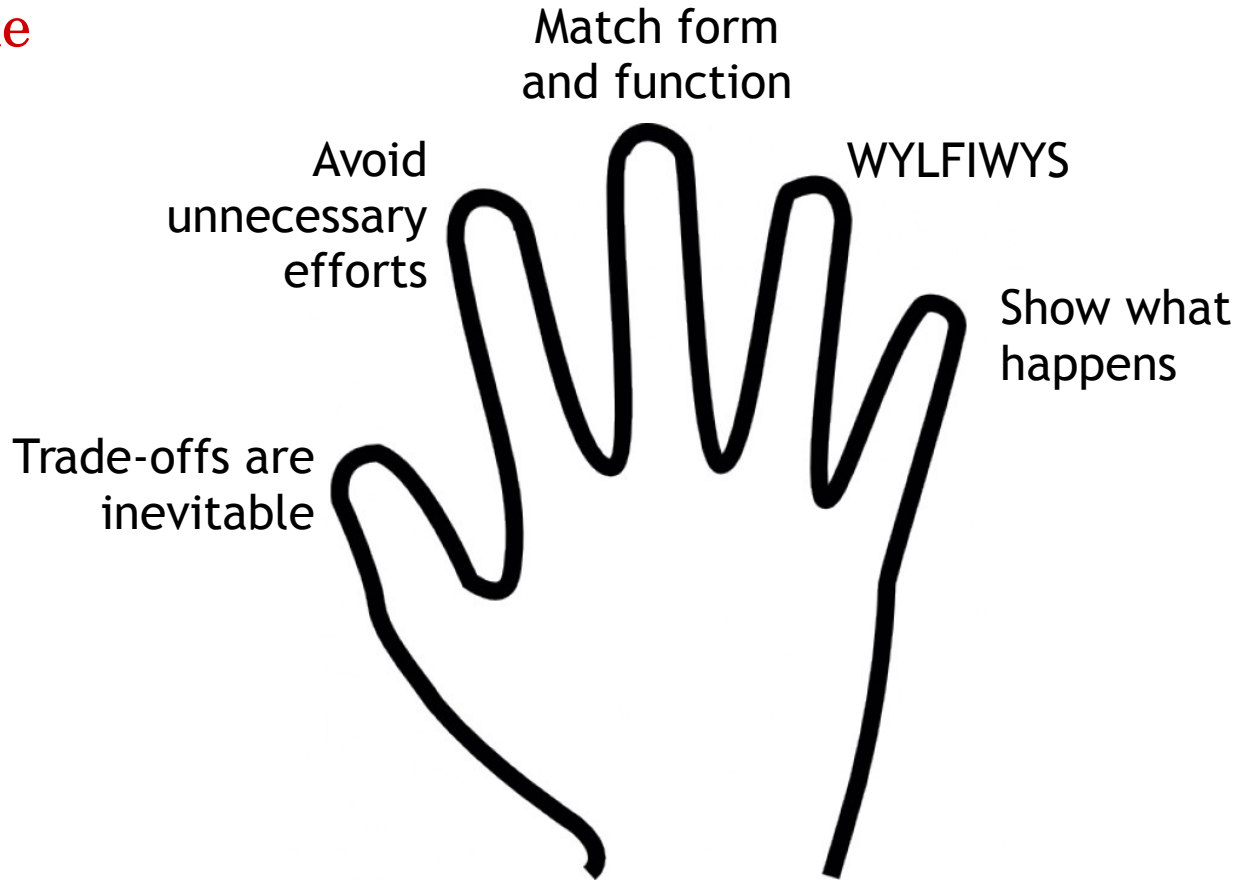
Summary: Human Factors as done

We cannot keep people in control unless we understand Work-as-Done



Remember the nitty-gritty

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