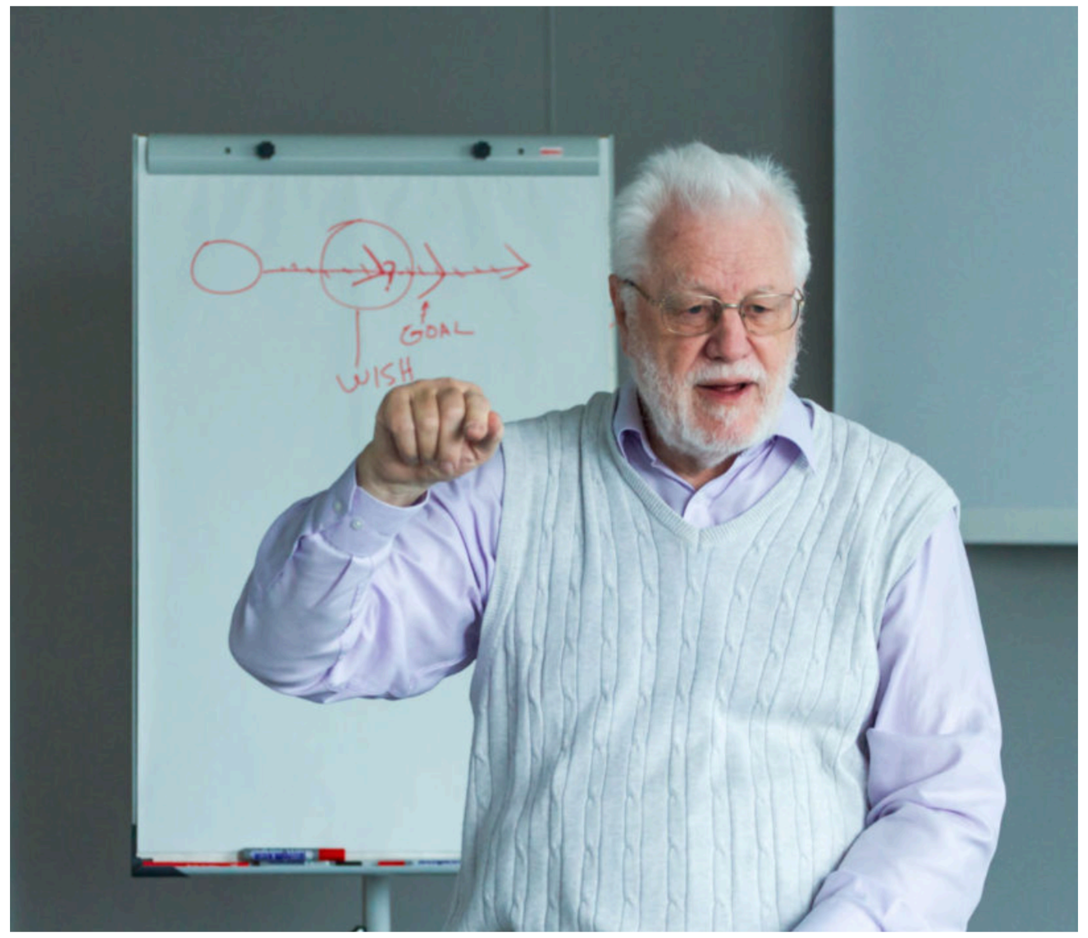
By Tom Gilb
tom@Gilb.com
www.Gilb.com
twitter.com/ImTomGilb
http://www.linkedin.com/in/tomgilb

A Total of 12

'Design Propositions':

As part of my 'Grand Theory of Design',



Pictures from Spring edition of the Masterclass
14 / 41

These Slides at
http://concepts.gilb.com/dl978
And
https://tinyurl.com/DesignPropositions

See the paper
http://concepts.gilb.com/dl956

A General Theory of Design: 'Planguage

By Tom Gilb, 2019   Version: 10 June 2019

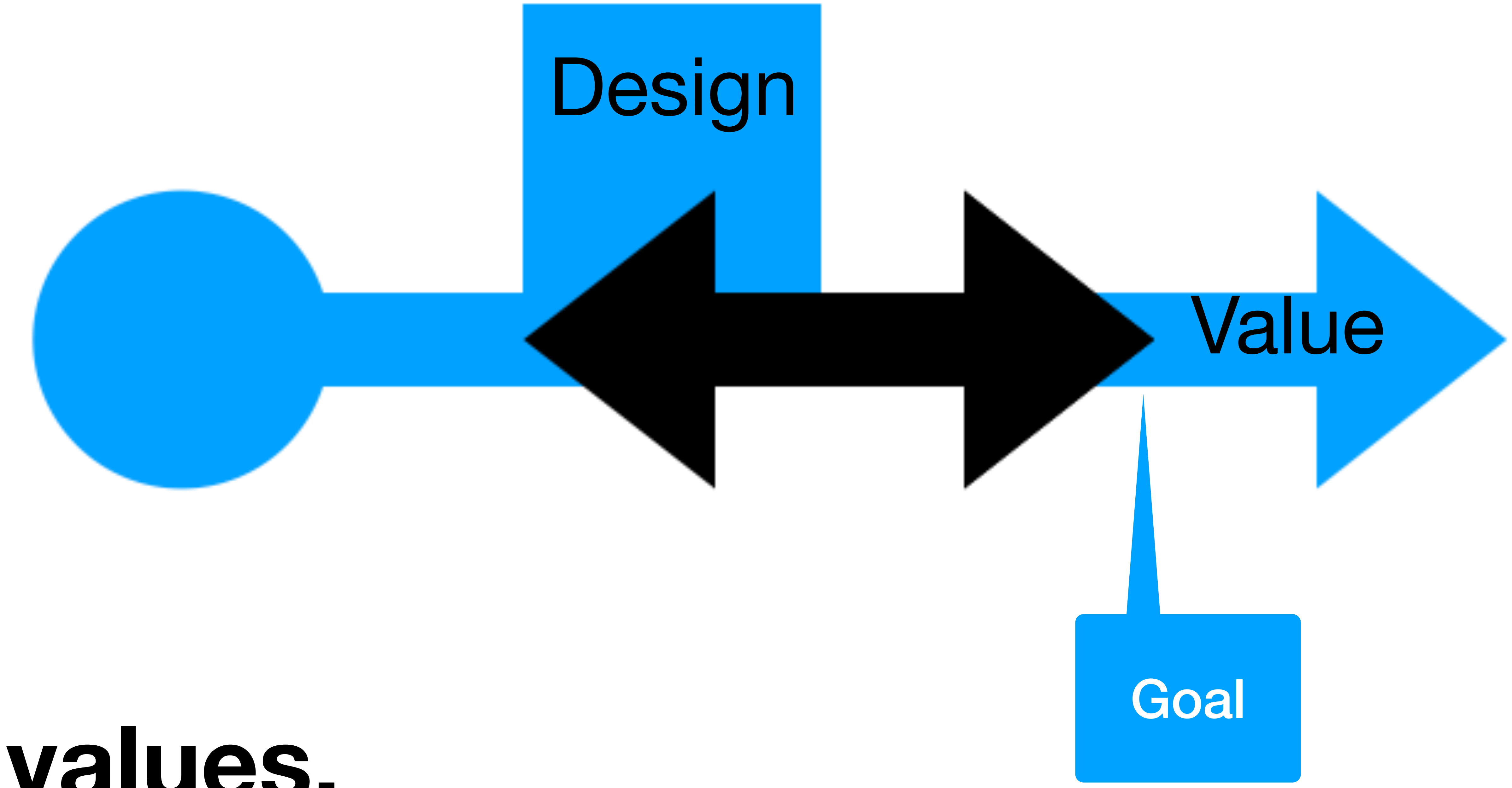
This is a *claim* to have, and to share freely, a '**General Theory of Design**'. A '*Grand* Theory' possibly.

See also : Gilb's Grand Design Theory: SLIDES JUNE 27 2019 GILBFEST
An Application for the Honour of being the first 'General Grand Design Theory'
http://concepts.gilb.com/dl959

OUR WEBSITE FOR ALL DOWNLOADS
http://concepts.gilb.com/file24
This will contain all old papers, slides etc and newer ones than this.

For presentation Tuesday 23rd June 2020
14:00 to 14: 30. (15+15)
At e-GilbFest

- **Part A. The Propositions.**



- **Design Idea ('A Design'):**
  - **is a specification,**
  - **made with the intent,**
  - **to deliver some stakeholder values,**
  - **using limited resources,**
  - **within specified constraints.**

- These Propositions are
  - Some **Fundamental Design Ideas of Planguage.**

Gilb's Design Proposition 1:

Design 'Attempt'

A '**design**': short form, noun, for 'design idea' a Planguage Concept

- **A 'Design'**
  - ***attempts***
    - **to *improve the 'distance moved'***
  - ***from* a *known* performance status level**
    - (benchmark),
  - ***towards* a *required* level of performance***
    - (target, or constraint)**,**
  - ***within* resource constraints,**
  - ***while meeting* other specified constraints.**

* Performance — Concept *434 June 5, 2003
System performance is an attribute set that describes measurably 'how good' the system is at delivering *effectiveness* to its stakeholders.

Benchmark Target
O———-<—————————>———————> Stakeholder Value X, Scale
-The Design Gap-

***Figure 1a**. The 'design gap' is an area of **potential improvement**, in the 'level of a stakeholder value',*

for example: a reliability quality, on an MTBF Scale.

*It is the **core mission of a 'design'** to try to **fill this gap.***

- ***A design is as good as:***
  - *the degree to which it **promises**,*
  - *and then in **reality**, fills the gap,*
  - *and thus reaches towards (or exceeds), the target level, the 'success level'.*

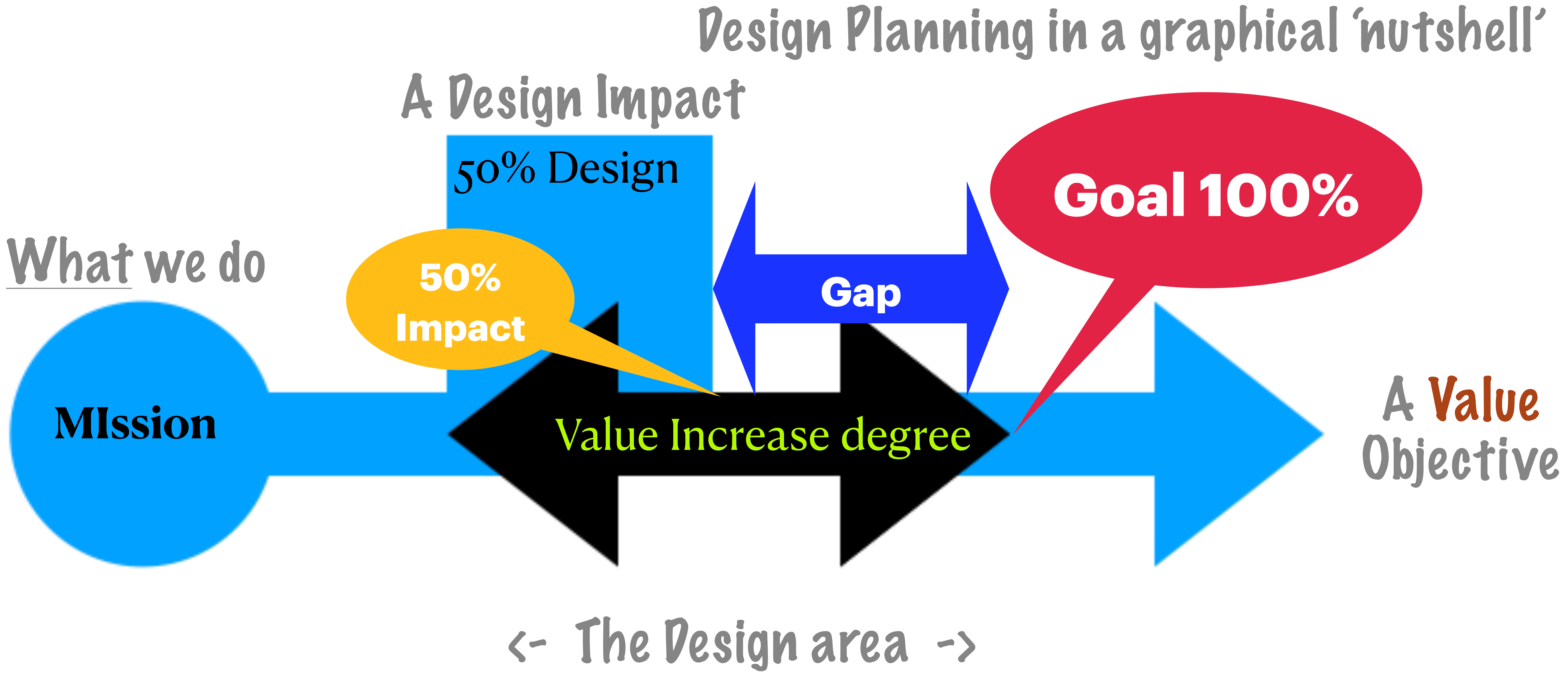
The above illustration makes use of Planguage 'keyed icons' (2nd line, at top here)

O———-< **[Design A]**———->———————> Stakeholder Value X, Scale
-The Design Gap-
Remaining

- ***Figure 1b**. Design A is **useful**.*
- *It makes interesting, non-trivial progress towards our Target level.*
- *But, it is not **sufficient**.*

- *It can be*
  - ***(a.) re-specified to have greater impact,***
  - ***or (b.) replaced with another design, with sufficient impact,***
  - ***or (c.) we can add other designs - which increment the impact to the target, at least.***

The 'Planning' Icons (Value, Design, Impact, MIssion, Gap)



Yes I have designed a graphical icon language for Objectives and Designs

Plicons: A Graphic Planning Language for Systems Engineering
gilb.com/DL37

Proposition 1 Consequences

Benchmark Target
O———-<—————————->——————-> Stakeholder Value X, Scale
-The Design Gap-

Clear requirements for design understanding

- If the **benchmark** is not well defined
  - By a scale of measure
  - By [Scale parameter] Conditions (who, where, when, etc.)
  - Then it is **logically impossible to know** how any design will move the system away from that (*effectively unknown*) current benchmark.
- In addition, the benchmark level present, when a particular sub-design is inserted in the system, may well have *changed*, from benchmarks known,
- when the design was originally suggested (to a new Status)
  - Which could render the **design invalid**, or ineffective

- If the **<u>improvement levels</u>** (Tolerable, Goal etc)
- Are not defined equally clearly to the Benchmark, and numerically on an unambiguous Scale of measure, with clearly defined [Scale parameter] conditions (who, what, when, etc.)
- Then, it will be **logically impossible** to
  - estimate or measure the effectiveness
  - of any proposed design;
  - in terms of moving us towards required (*effectively unknown*) improvement levels.

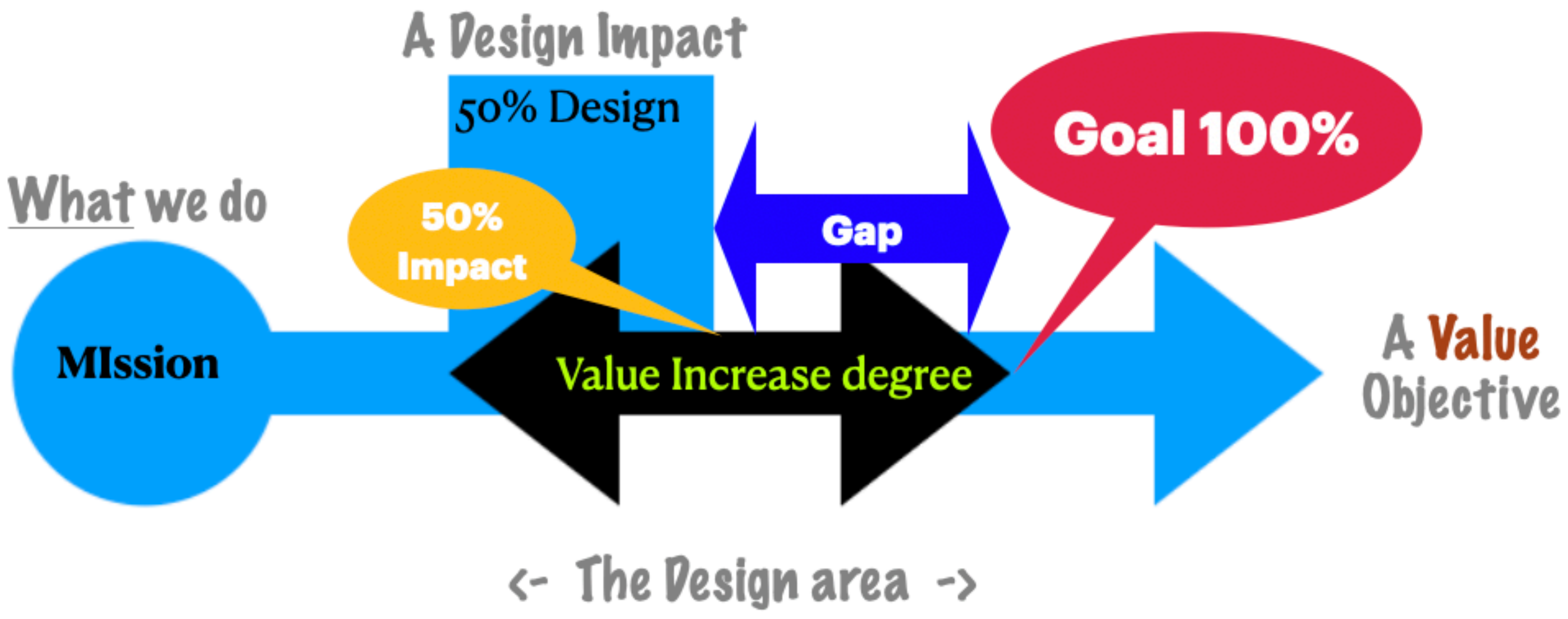
Categories of Design Success.

(how good is your design process?)

Gilb's Design Proposition 2.

Design Usefulness.

O———-<[Design A], Δ [Design B]>_—————-> Stakeholder Value X, Scale



- A design is **useful**
  - when it
  - in fact
  - *does* improve the distance,
  - towards a required level of performance,
  - without *unacceptable* side-effects,
  - on other levels of performance, and on budgeted resources.

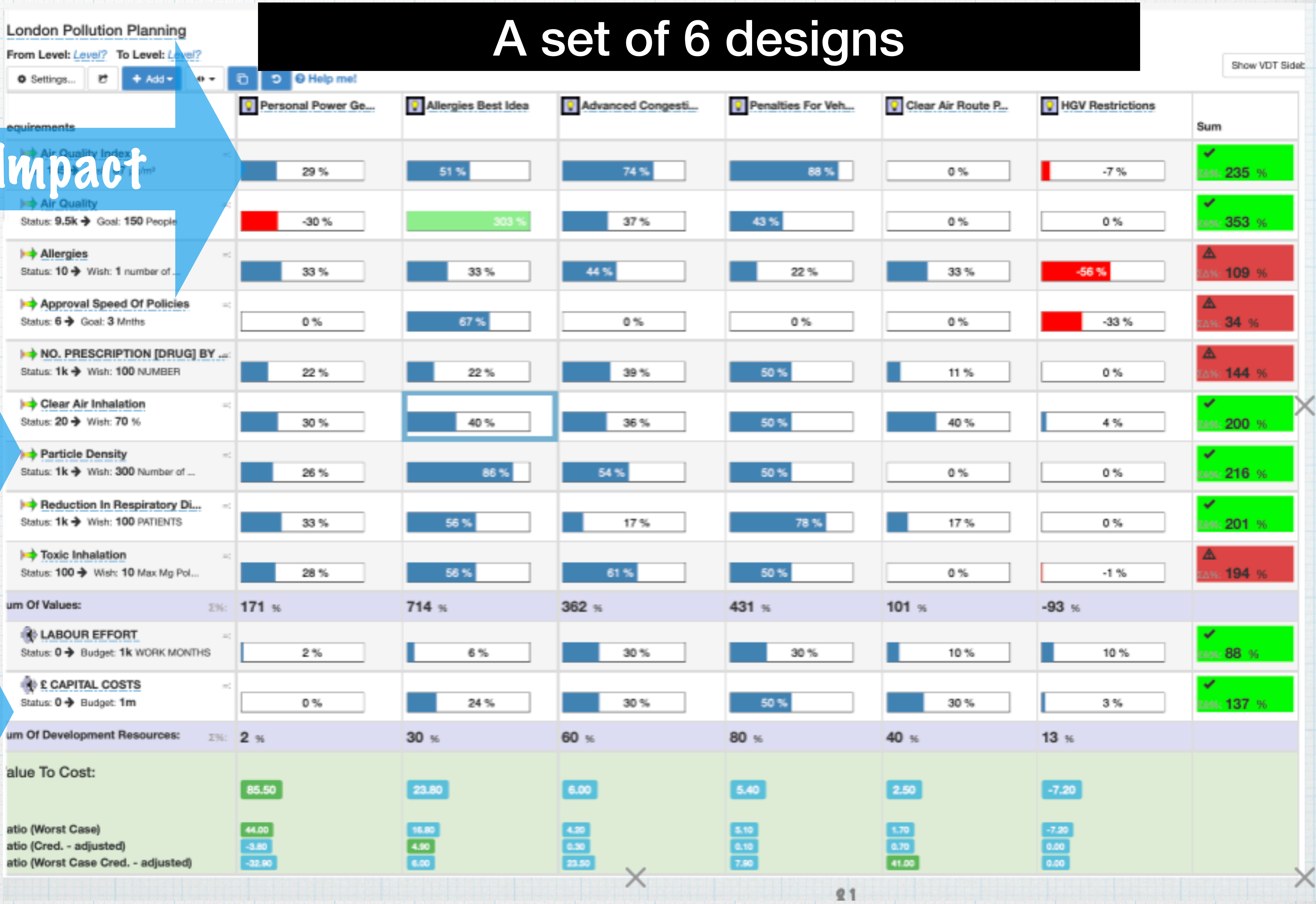
Prop. 2 Usefulness: Consequence

If you cannot estimate and measure actual numeric movement towards 'required performance levels'
Then you have no real control over your design process.

You can just 'suck it and see'.
Which is a craft, or trade, but not a predictable engineering discipline

Some Basic Principles for design

1. Your designs must contribute substantially to your value objectives at low costs: estimate and measure the levels
2. If you *try out your design ideas in small increments*, you can adjust designs, and 'never fail big'.
3. All designs have at least 9 side-effects on your critical values, and at least 6 cost aspects, some very negative; so you need to try to *discover these, as soon as you can, estimate, then measure their delivery incrementally.*
4. Your designs need to be *tried out in practice, in small increments*, so if they disappoint, you can *dump them fast*.



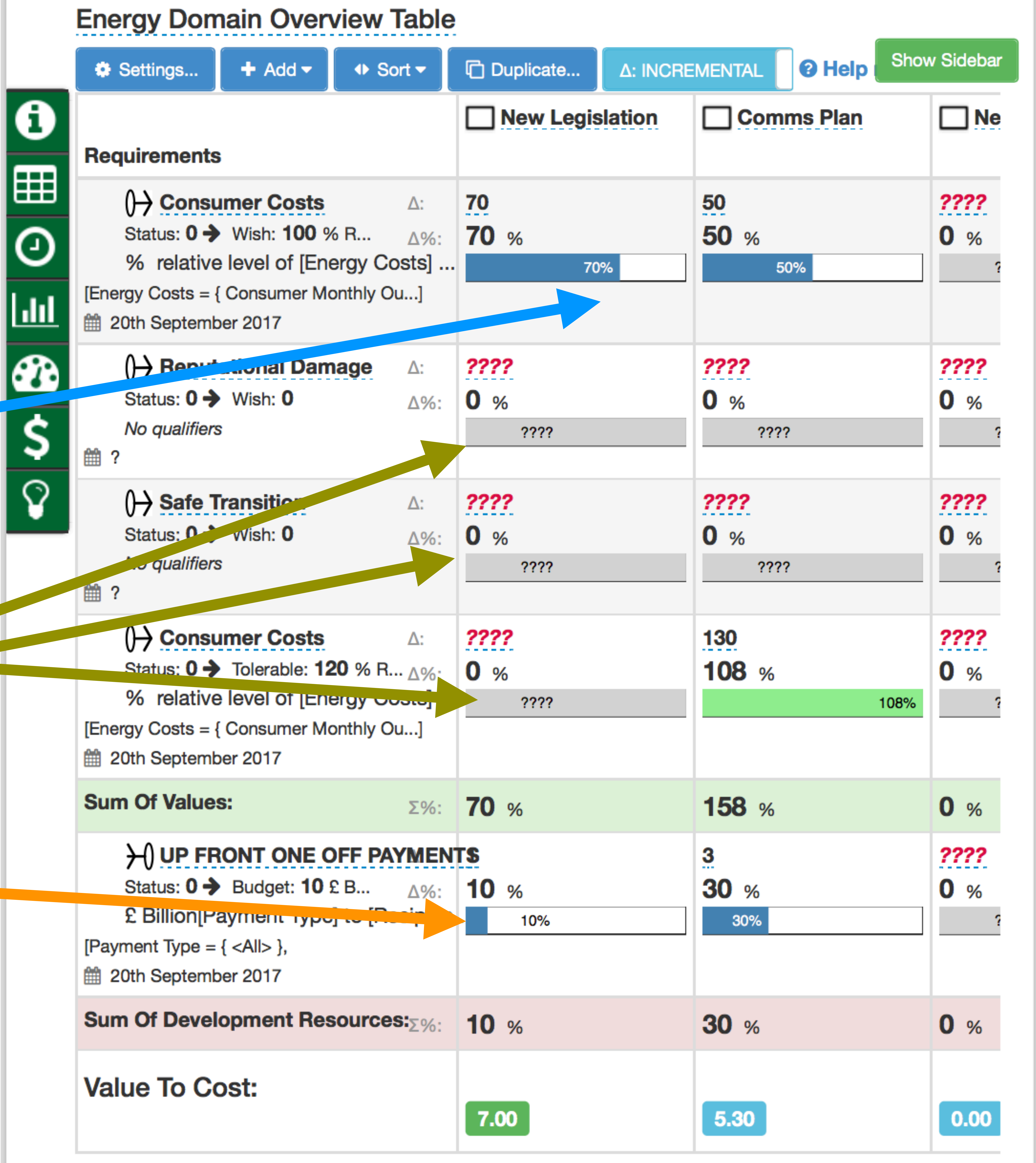
equirements	Personal Power Ge...	Allergies Best Idea	Advanced Congesti...	Penalties For Veh...	Clear Air Route P...	HGV Restrictions	Sum
Air Quality Index	29 %	51 %	74 %	88 %	0 %	-7 %	235 %
Air Quality Status: 9.5k → Goal: 150 People	-30 %	303 %	37 %	43 %	0 %	0 %	353 %
Allergies Status: 10 → Wish: 1 number of ...	33 %	33 %	44 %	22 %	33 %	-56 %	109 %
Approval Speed Of Policies Status: 6 → Goal: 3 Mnths	0 %	67 %	0 %	0 %	0 %	-33 %	34 %
NO. PRESCRIPTION [DRUG] BY ... Status: 1k → Wish: 100 NUMBER	22 %	22 %	39 %	50 %	11 %	0 %	144 %
Clear Air Inhalation Status: 20 → Wish: 70 %	30 %	40 %	36 %	50 %	40 %	4 %	200 %
Particle Density Status: 1k → Wish: 300 Number of ...	26 %	86 %	54 %	50 %	0 %	0 %	216 %
Reduction In Respiratory Di... Status: 1k → Wish: 100 PATIENTS	33 %	56 %	17 %	78 %	17 %	0 %	201 %
Toxic Inhalation Status: 100 → Wish: 10 Max Mg Pol...	28 %	56 %	61 %	50 %	0 %	-1 %	194 %
um Of Values:	171 %	714 %	362 %	431 %	101 %	-93 %	
LABOUR EFFORT Status: 0 → Budget: 1k WORK MONTHS	2 %	6 %	30 %	30 %	10 %	10 %	88 %
£ CAPITAL COSTS Status: 0 → Budget: 1m	0 %	24 %	30 %	50 %	30 %	3 %	137 %
um Of Development Resources:	2 %	30 %	60 %	80 %	40 %	13 %	
alue To Cost:	85.50	23.80	6.00	5.40	2.50	-7.20	
atio (Worst Case)	44.00	16.80	4.30	5.10	1.70	-7.20	
atio (Cred. - adjusted)	-3.80	4.90	0.30	0.10	0.70	0.00	
atio (Worst Case Cred. - adjusted)	-32.90	6.00	23.50	7.90	41.00	0.00	

Gilb’s Design Proposition 3.

Single-Dimensional Success.

An immature idea of design

- A design is only
  - **‘narrowly successful’**
  - when it reasonably attains its **expected** (estimated) level of performance improvement,
  - without us considering design **side-effects**
    - (on **other** performance requirements,
    - or budgeted **resources**)



Consequences of Prop. 3 Single-Dimensional
If you fail to systematically look at side-effects
You then risk some nasty surprises, even total failure.
Good engineering practice says, look at side effects, during design, not when it is too late.

Understanding that we probably have the required resources to use the strategy. ONE DIMENSION OF COST? Are there cheaper ideas? Can we afford it?

* Let’s assume you have one or more strategy options that are acceptable, in terms of the questions above.

* And let us assume all candidates look roughly as good as any other.

* So they *might* deliver the value levels you require.
    * But can you afford them?
    * And is any option much cheaper or faster than the others?

* We can ask the following questions about the options, in order to pick a ‘resource winner’:

1. is the design specified <u>in enough detail</u>, that we can hope to estimate costs roughly ?

   (Order of magnitude, or maximum).

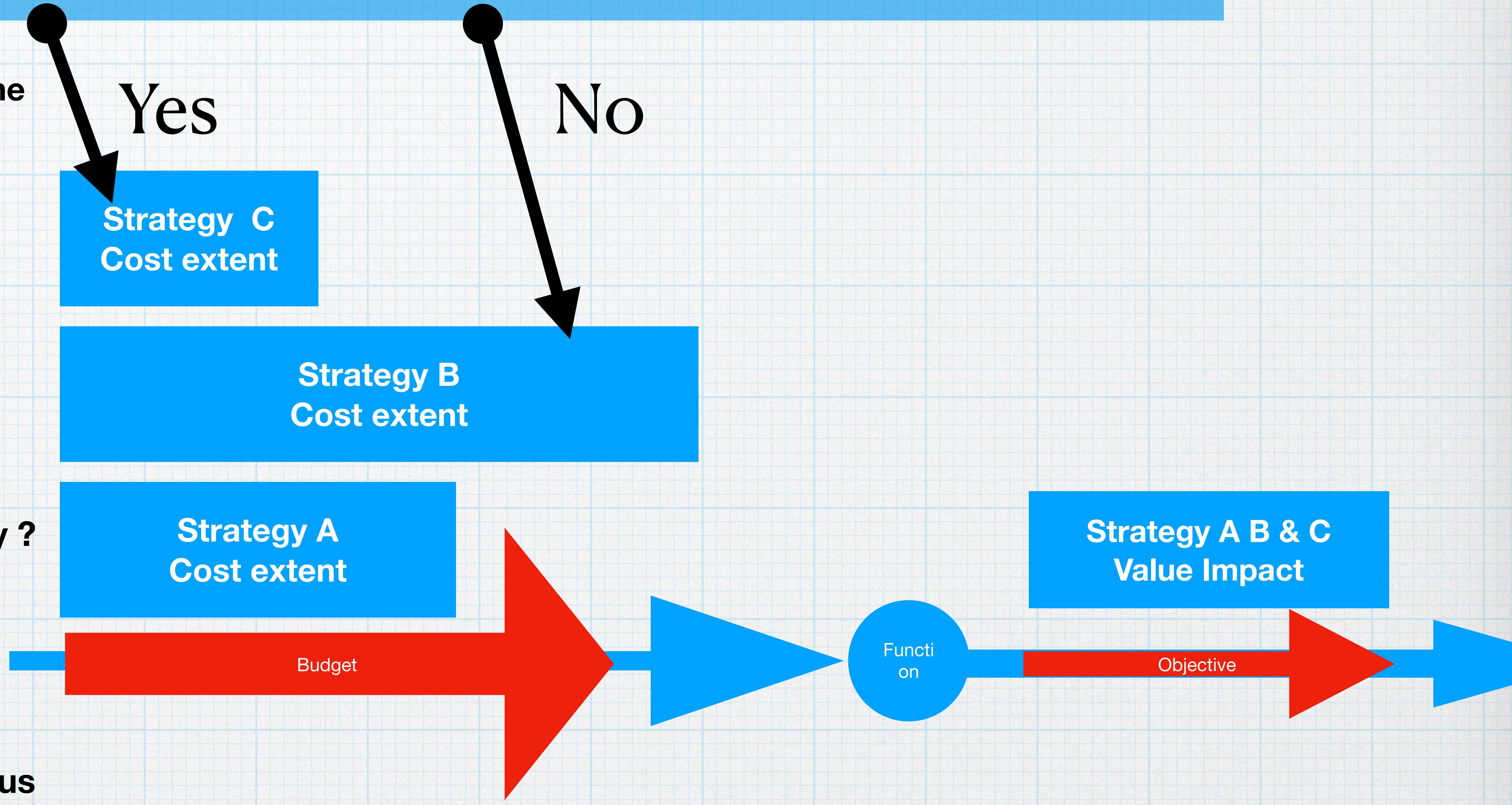
2. Vague strategy specifications have a very broad ‘cost range’.

3. Do we know any resource information (time, people, money) at all about any previous

   uses of our options, by anyone, anywhere?

4. Can we get a sub-supplier to give us a fixed price, fixed-delivery-time contract, for the

   options?



Cost-effective strategy selection
Or ‘Efficient’ strategy selection

These questions will help you point to a likely, cost-effective (‘efficient strategy’) candidate.

In some situations, that might be enough to go ahead and try the promising-designs out.

In other situations you would be gambling, too much of someone else’s money and lives; so you might like some even-more-advanced strategy-resource-estimation-and-tracking-methods, for those cases.

Gilb's Design Proposition 4.

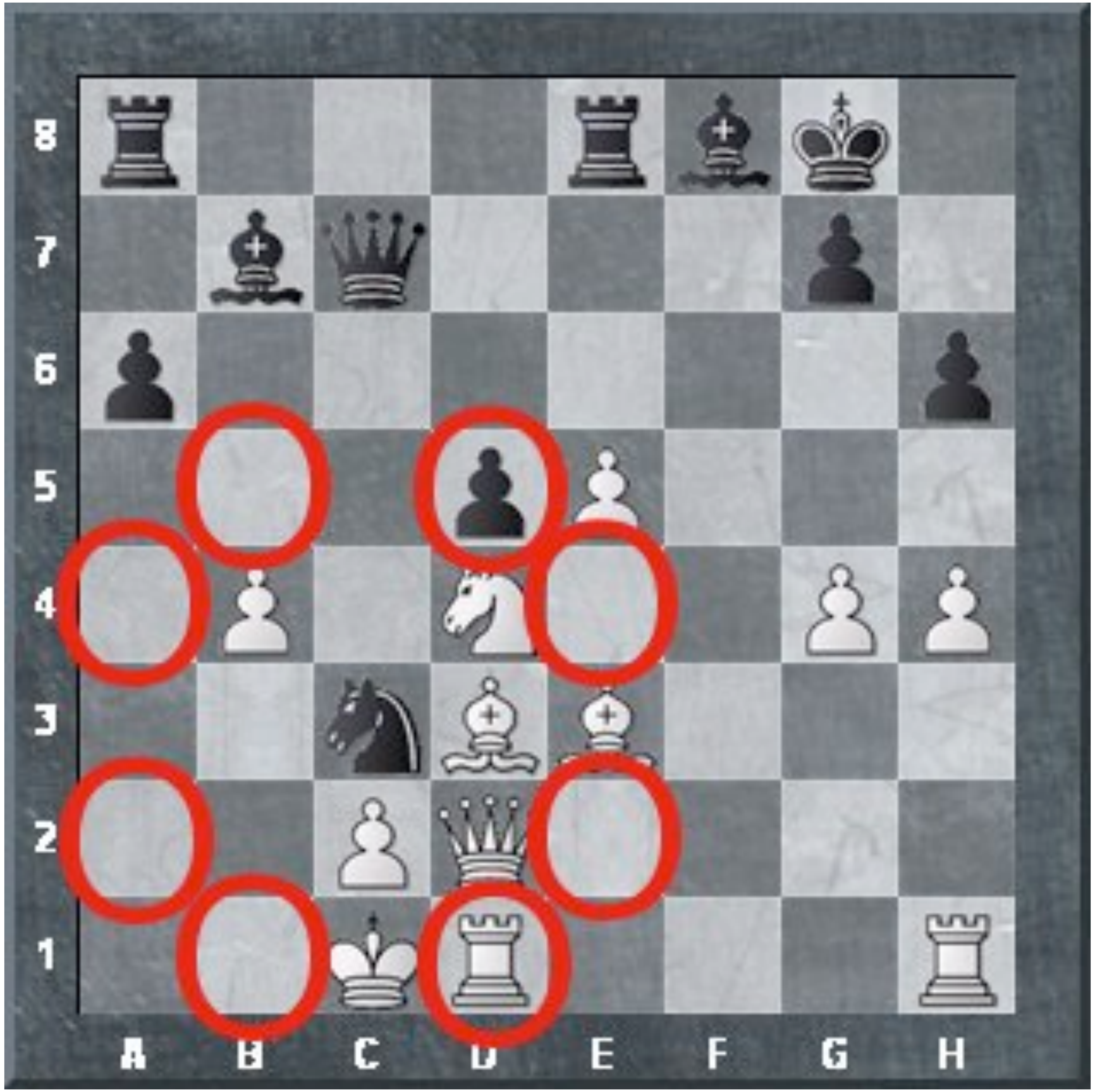
Multi-dimensional Success

A design is

- **'reasonably successful'**
  - when it meets or exceeds
  - its *expected performance improvement*,
  - while having some useful side effects
    - on other required performance requirement levels,
  - and having expected-or-lower impact on budgeted resources.

Prop. 4 Consequences: Multi-dimensional Success

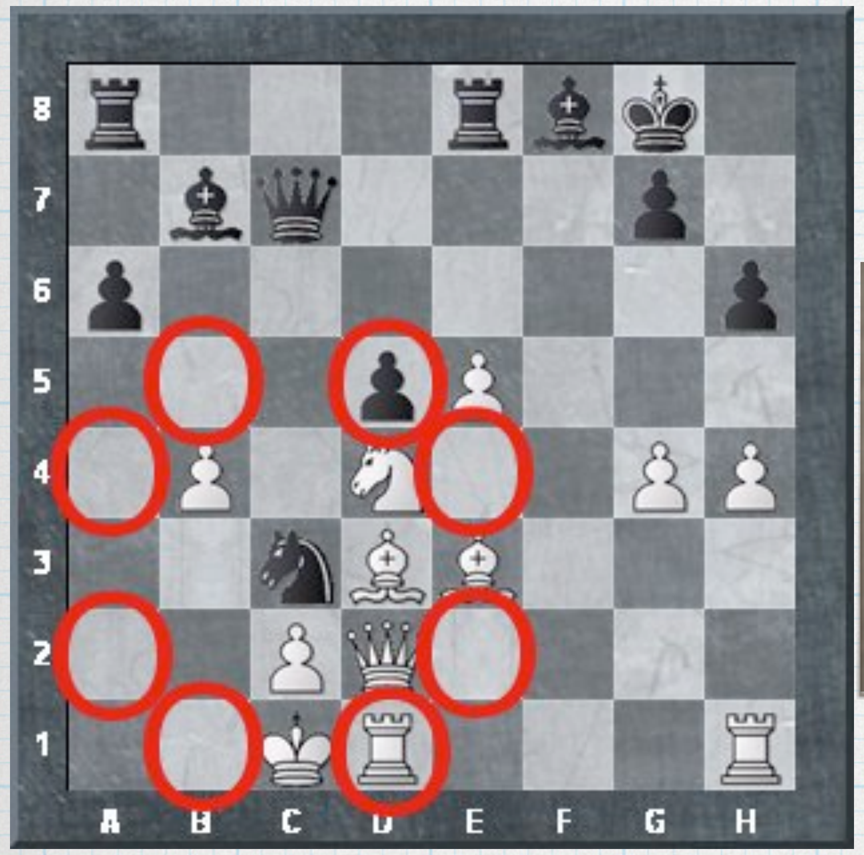
If you do not quantify, estimate
and measure the side-effect impacts,
then you can miss out of many valuable improvements,



SIDE EFFECTS WILL 'GET YOU', LATER, ANYWAY, SO CONSIDER side-effects EARLY:
It is oversimplification to think in terms of
the 'right strategy' for a single sustainability goal:
all strategies will have 'side effects' on most other competing sustainability goals,
and they will ALSO impact a variety of constraints ('laws' for example)
and ALSO impact costs ('maintenance costs' for example).

* If this is the main intended value effect of a strategy

Main



How many 'side-effects' can one chess piece position have?

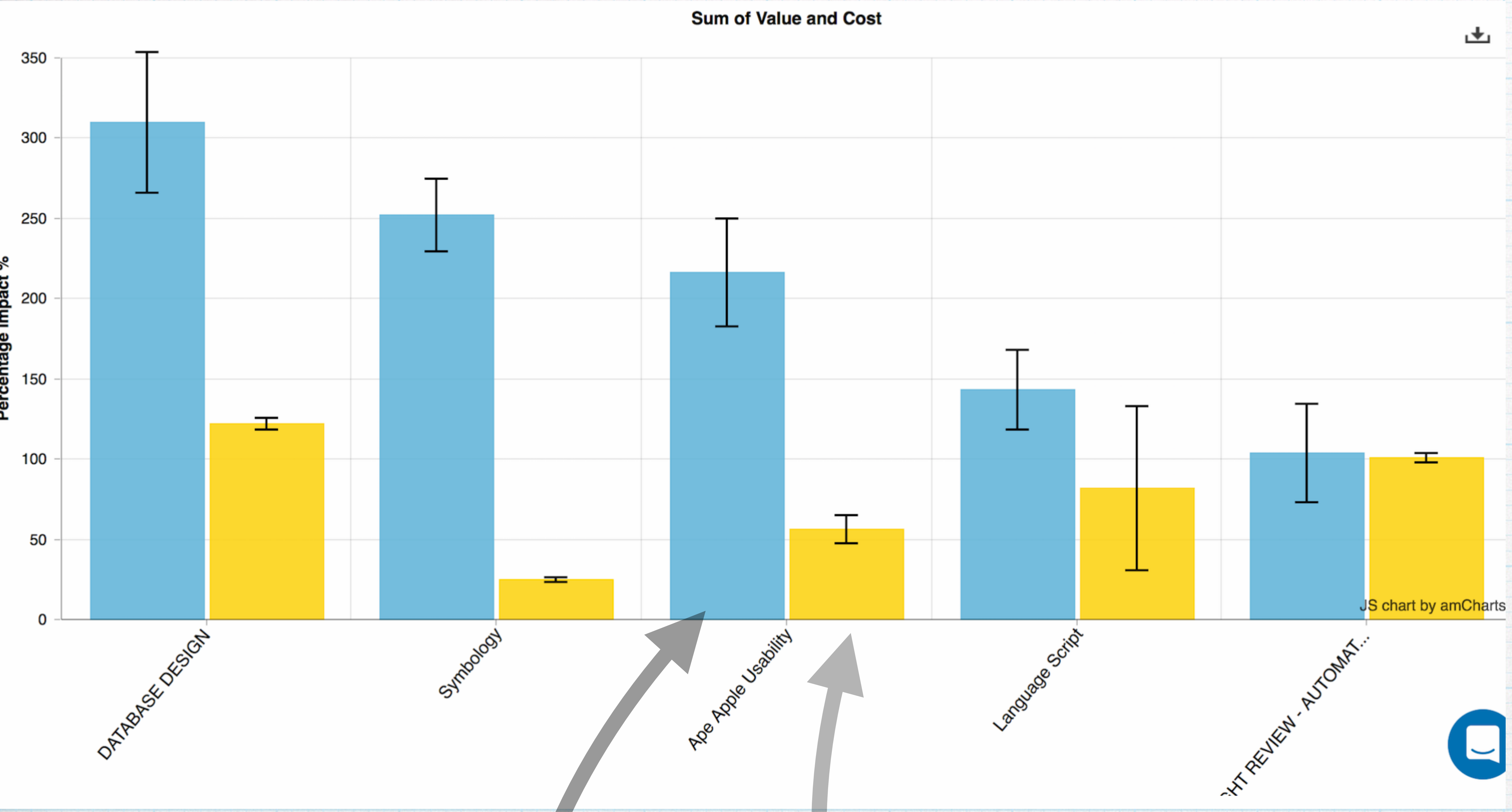
Side

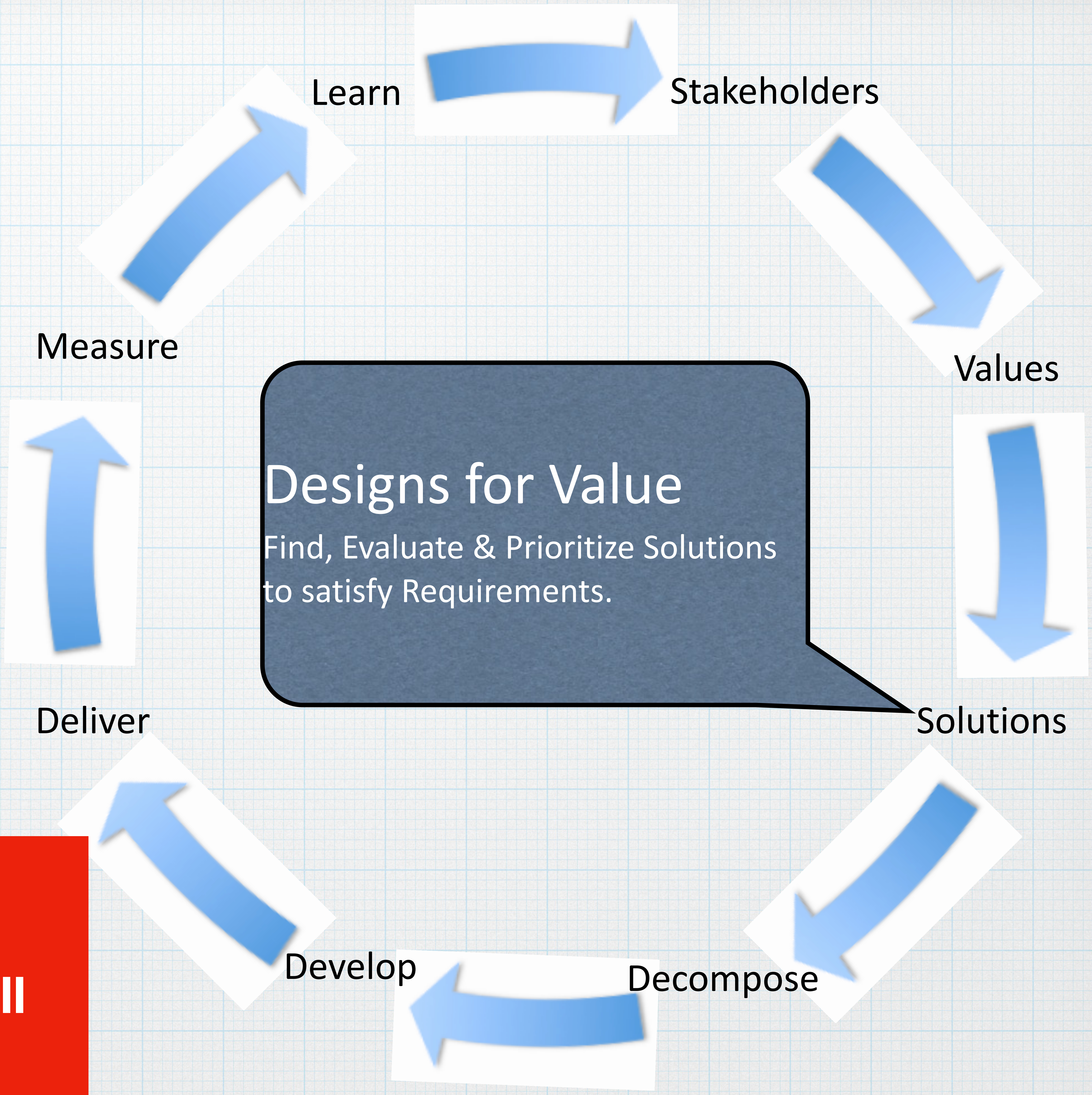
* Then, all these other impacts on our Goals, are 'side effects'

equirements	S1 End Poverty	S2 End Hunger Str...	S3 Healthy Lives	S4 Quality Educatio
G1. Poverty (Decomposed) Status: 0 ➔ Goal: 100 % of sub-gΔ%:	95 95 % 95%	???? 0 % ????	???? 0 % ????	???? 0 % ???? Show Sidebai
G2 End Hunger Δ: Status: 0 ➔ Goal: 100 % of sub-gΔ%:	42 42 % 42%	96 96 % 96%	???? 0 % ????	Δ:???? Δ%: 0 % ????
G3 Healthy Lives Δ: Status: 0 ➔ Goal: 100 % of sub-gΔ%:	-42 -42 % -42%	23 23 % 23%	???? 0 % ????	???? 0 % ????
G4 Quality Education Δ: Status: 0 ➔ Goal: 100 % of sub-gΔ%:	5 5 % 5%	-12 -12 % -12%	???? 0 % ????	???? 0 % ????
G5 Gender Equality Δ: Status: 0 ➔ Wish: 100 % of sub-gΔ%:	-5 -5 % -5%	0 0 % 0%	???? 0 % ????	???? 0 % ????
G6 Water And Sanitation Δ: Status: 0 ➔ Wish: 100 % of sub-gΔ%:	???? 0 % ????	42 42 % 42%	???? 0 % ????	???? 0 % ????
G7 Energy Access Δ: Status: 0 ➔ Goal: 100 % of sub-gΔ%:	0 0 % 0%	3 3 % 3%	???? 0 % ????	???? 0 % ????
G8 Employment And Growth Status: 0 ➔ Goal: 100 % of sub-gΔ%:	33 33 % 33%	-12 -12 % -12%	???? 0 % ????	???? 0 % ????

Let me introduce a concept you need for Sustainability planning
Multi-Dimensional Thinking and Decision-Making .
HOW MANY TENNIS BALLS CAN YOU JUGGLE WITHOUT DROPPING ANY?

Solutions prioritized By Values/Costs ratio Left to right





The Impact Table can ‘add up’ the % impacts and costs of a design. So that we can easily compute an overall Value (S) and Costs (S) effect. And then use that to prioritise the best design

Design Impact Analysis

Make sure you *really* understand, how good your suggested 'means' will be, for your many 'value objectives'.
Give facts and evidence for strategies!
Not political assertions, in *one* dimension.

MULTI-DIMENSIONAL ENGINEERING THINKING

Every candidate design will be analyzed, using an Impact Estimation Table.

QUANTIFIED Design-analysis will be used,to select and prioritize strategies.

Design analysis will be based on value side-effect analysis, critical resources analysis, and other constraint analysis (legal, GDPR).

Estimates will be made using named person or team estimators, using evidence of experience, sources of evidence, and ranges of experience (± uncertainty ranges)

Worst case analysis regarding Credibility (evidence and source) and ± range of experience, will be calculated and presented.

HEALTHCARE SYSTEM IMPACT ESTIMATION

	Automate Rules	Web Self Service	Decision Support	Total Impacts
Increase Transmission of Requests *(30 minutes → 10 minutes)*	10 minutes 100%	3 minutes 100%	-	200%
Decrease Number of Errors Occurring *(353 per week → 30 per week)*	100 errors 80%	< 50 90%	-	170%
Decrease Time for Processing of Requests *(70 minutes → 10 minutes)*	35 minutes 70%	-	< 10 minutes 90%	160%
Decrease Time to Learn process *(1 day → 1 hour)*	-	1 hour 100%	10 minutes 103%	203%
TOTAL DESIGN REQUIREMENT IMPACT	250%	290%	193%	

Deliver Pharmas to Patient Planning

SIMPLE REAL UK NHS VALUE DECISION TABLE

a real Health service, UK, table, successful project (source: http://www.gilb.com/dl582). Man-Chie Tse and Ravinder Ravi Singh Kahlon

Detail of estimates, uncertainty, evidence, source
(managing risks of designs)
For serious designs (Covid-19, Brexit) estimate credibility and risks can be considered too

A BCS class Project

Requirements		Incentivise	Tea Kiosk	Daily Danger Checks
Project Timeliness Status: **10** ➔ Wish: **5** % % time overrun necessary to deliver [Project Cost Size = { Medium ($10k -...] 30th June 2017	=: Δ: Σ%: ?%:	**8** ± 0 -2 % **40** ± **0** % *32 % (x 0.8)* 40%	**5** ± 1 -5 % **100** ± **20** % *50 % (x 0.5)* 100%	**15** ± 8 5 % **-100** ± **160** % *-80 % (x 0.8)* -100%
Building Security Status: **50** ➔ Wish: **10** % I... % of [Emergency Types] which in fact... [Emergency Types = { Earthquake }, 30th June 2018	=: Δ: Σ%: ?%:	**50** ± 0 0 % Injury **0** ± **0** % *0 % (x 0.0)* 0%	**50** ± 0 0 % Injury **0** ± **NaN** % *0 % (x 0.6)* 0%	**30** ± 10 -20 % Injury **50** ± **25** % *15 % (x 0.3)* 50%
User Productivity Status: **15** ➔ Wish: **5** minutes number of minutes for a [user] to co... [user = { adult }, task = { dri...] 30th June 2017	=: Δ: Σ%: ?%:	**10** ± 0 -5 minutes **50** ± **0** % *0 % (x 0.0)* 50%	**8** ± 3 -7 minutes **70** ± **30** % *56 % (x 0.8)* 70%	**15** ± 0 0 minutes 0%
Sum Of Values: Credibility - adjusted:	Σ%: Σ?%:	**90** ± **0** % *32 %*	**170** ± **50** % *106 %*	**-50** ± **185** % *-65 %*
Method Implementation Cost Status: **0** ➔ Budget: **3m** $ Total monetary cost in US Dollars fo... [Project Cost Size = { }] 30th June 2017	Δ: Σ%: ?%:	**500k** ± 0 500k $ **17** ± **0** % *34 % (x 0.0)* 17%	**2m** ± 0 2m $ **67** ± **0** % *134 % (x 0.0)* 67%	**1m** ± 0 1m $ **33** ± **0** % *66 % (x 0.0)* 33%
Sum Of Development Resources: Credibility - adjusted:	Σ%: Σ?%:	**17** ± **0** % *34 %*	**67** ± **0** % *134 %*	**33** ± **0** % *66 %*
Value To Cost:				

Selected Impact Target

Row: User Productivity
Col: Tea Kiosk
Scale: number of minutes for a [user] to complete a [task]

Value Impact: Change...

Estimate: minutes
Δ -7 ± 3

Actual: minutes
Δ scale val ± 0

Credibility: 0.8

In-house measurements of design / strategy correlate to external sources

Evidence:
we have used tea kiosks and several competitors have which save about seven minutes for users

Source:
https://www.tripadvisor.com/ShowUserReviews-g154995-d4871495-r475327934-McDonald_s-London_Ontario.html

Add Comment...

Specification Rules for ‘**Designs**’

https://www.gilb.com/p/competitive-engineering (free pdf)

Rules here

Version 22 June 2XXXTG, owner Tom .

Strategies/Initiatives: Defined As: means to impact the Objectives.

S1 (Use General Rules) - see next slide

General Rules, Version June 22th 2000 (apply to any plan) Owner: Tom Blanco

S2: Template: Use the suggested template. ”Strategies Template” .

S3.: Model: see best practice model for other insights: “#2 Initiative June 22”

S4: Spec: The specification must be detailed enough and clear enough to understand the impacts of the strategy in terms of value delivered and costs.

S5. Real Impacts: The impacts are initially estimated on the scale of measure defined for a particular objective. So you need to specify the expected change from a defined baseline for the implementation of the strategy.

S6: (% Impacts) Impacts can also be expressed in terms of % progress on the real scale from the current level (0%, usually a Benchmark such as Past level), to the target level (usually a Plan level, 100% if on timel).

S7 (Costs). All relevant cost aspects should be estimated as well as possible.

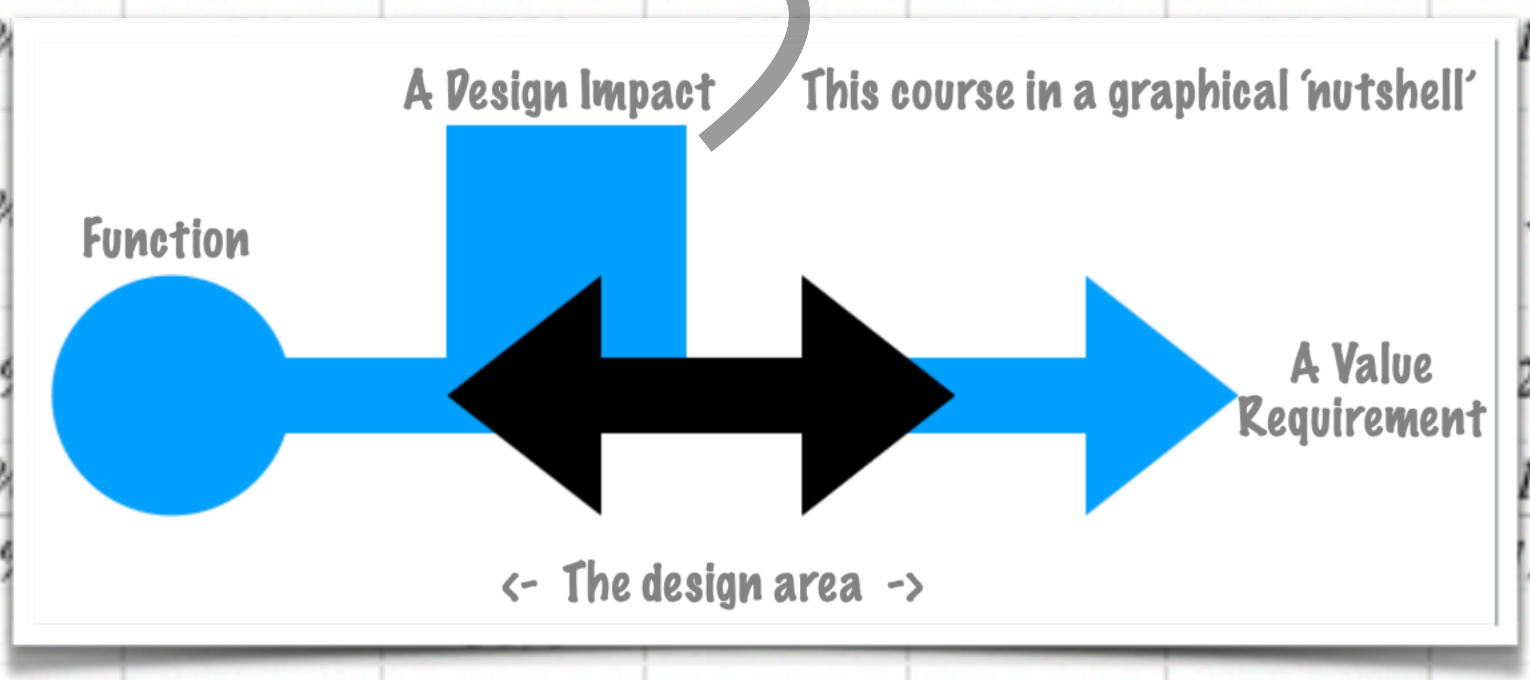
S8 (Risks) All potential risks which can negatively influence the estimated impact need to be stated. This is to permit pro-active planning to contain those risks.

S9 (Assumptions). Any assumptions which the impact & timing of impact rests on need to be specified; again to that we can actively make sure these assumptions hold.

These Rules were suggested for a USA Government Bank

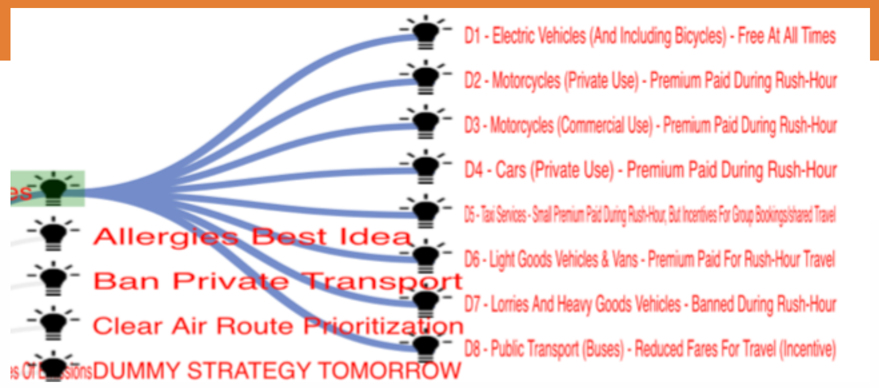
Planning Brexit

Strategy Proposals / Risks	*Market Comms plan*	*Comms plan to eg. Market Players + DEx-EU*	*Guidance to No. 10/ Negotiator s*	*SIs / Legal strategy (eg. Baseline design)*	*CM Market (Contingency?) Planning*	*Alternate / un-mothballed Trading Systems*	*REMIT Capability*	*Economic Modelling*	*Joint-Planning with Regulators + Operators etc*	*Sum Strategy Impacts*
1. Uncertainty in Exit Negotiations (for legislation)	0%	0%	5%	25%	0%	0%	0%	10%	15%	55%
2. Market Uncertainty (supply/ investment)	15%	15%	5%	15%	5%	10%	5%	0%	15%	85%
3. Capacity / Supply shortfalls	15%	20%	10%	20%	60%	15%	0%	10%	25%	175%
4. Price increases (to unacceptable)	5%	5%	5[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	15%	80%
5. Trading Systems unavailable/ ineffective	0%	0%	5[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	5%	60%
6. Reputation Risk	30%	20%	10[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	25%	230%
7. Market Abuse	5%	10%	0[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	15%	120%
Sum Contributions	70%	70%	40[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	15%	
Percent £ budget										
Cost/Effectiveness										



Courtesy: C D

Prioritizing for next step value delivery, the design which has the largest SET (or SUM) of Value Impacts



Expanding Qualification Activities Value Table

From Level: Level? To Level: Level?

Settings... | Add | Sort | Duplicate... | Undo... | =: ABSOLUTE | Help me! | Show Sidebar

uirements		D3. Purchase E-L...	D2. Invite Exper...	D1. Send Employe...	D4. Invite Exper...
Adequate Qualifications Status: 39 → Wish: 0 % [Employe... % [Employees] have acquired [Skill Le...	=: Δ%:	87%	38%	51%	23%
Adequate Qualifications Status: 61 → Wish: 0 % [Employe... % [Employees] have acquired [Skill Le...	=: Δ%:	93%	26%	2%	67%
Adequate Qualifications Status: 0 → Wish: 50 % [Employe... % [Employees] have acquired [Skill Le...	=: Δ%:	60%	36%	30%	44%
Adequate Qualifications Status: 0 → Wish: 35 % [Employe... % [Employees] have acquired [Skill Le...	=: Δ%:	6%	31%	14%	34%
Adequate Qualifications Status: 0 → Wish: 15 % [Employe... % [Employees] have acquired [Skill Le...	=: Δ%:	0%	13%	7%	60%
ı Of Values:	Σ%:	246 %	144 %	104 %	228 %

FIGURE: HERE, FROM ANOTHER PLAN, IS A VALUE TABLE FOR DECIDING WHICH ONES OF THE SUB-DESIGNS ARE TO BE PRIORITIZED NEAR TERM (SOURCE POLISH EXPORT PLAN)

•

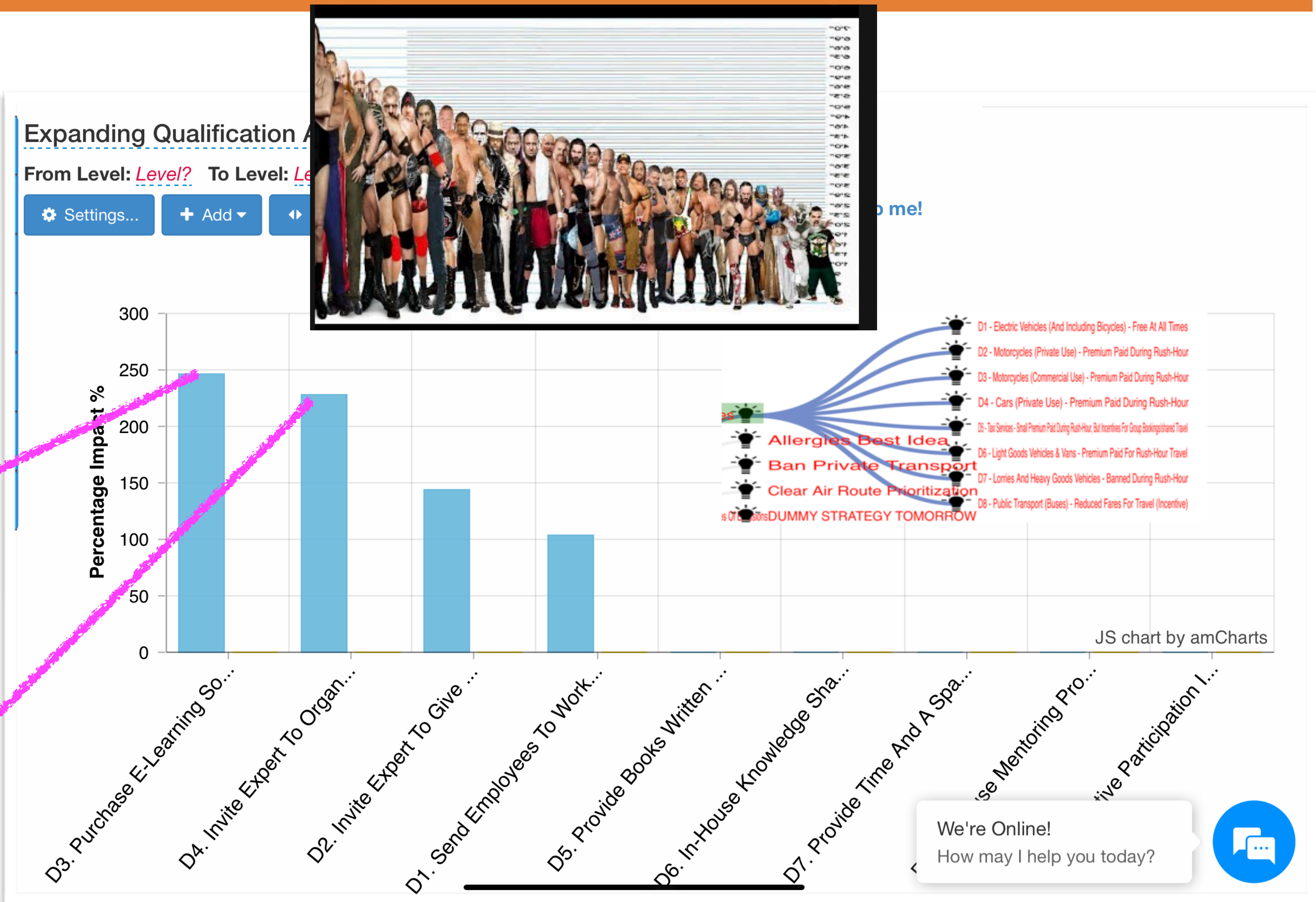


FIGURE: THIS BAR CHART IS EXTRACTED FROM THE TABLE AT LEFT, WE ASKED VALPLAN.NET TO SORT BY IMPACT TOTAL ON ALL VALUE REQUIREMENTS.
<u>LEFT-SIDE IS HEAD OF VALUE DELIVERY QUEUE</u>
THIS IS 'AUTOMATIC PRIORITIZATION OF DESIGN'. (SOURCE POLISH EXPORT PLAN)

Gilb's Design Proposition 5.

Comprehensive Success.

Great Designs are characterised…..

- A design is
  - **'very successful'**
  - when
    - it *exceeds* its expected performance improvement substantially,
- and **thus** contributes even more (than expected),
  - to meeting specified performance levels on time,
- **while also** having some very useful side-effects,
  - on other required **performance** requirement levels,
- **and also** having lower-than-expected impacts
  - on budgeted **resources**.

Sides

- This is similar to the situation in Proposition 4 above.
- With the exception of *substantially* exceeding the primary target level.

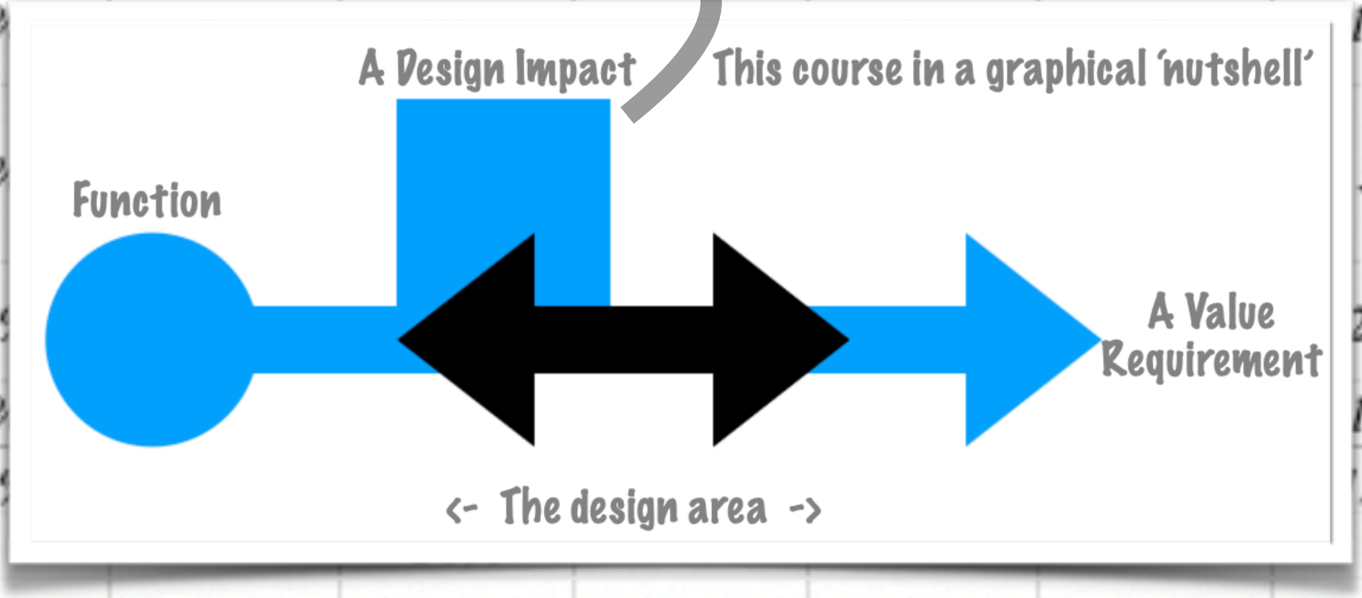
Prop 5. Consequences
You have to measure side effects, main effect, and costs: to know if you have a great design

The *set* of designs Impacts more than Success Goal levels '100%' = 'expected level'

Brexit Energy Planning

———————-Designs———

Strategy Proposals / Risks	*Market Comms plan*	*Comms plan to eg. Market Players + DEx-EU*	*Guidance to No. 10/ Negotiators*	*SIs / Legal strategy (eg. Baseline design)*	*CM Market (Contingency?) Planning*	*Alternate / un-mothballed Trading Systems*	*REMIT Capability*	*Economic Modelling*	*Joint-Planning with Regulators + Operators etc*	*Sum Strategy Impacts*
1. Uncertainty in Exit Negotiations (for legislation)	0%	0%	5%	25%	0%	0%	0%	10%	15%	55%
2. Market Uncertainty (supply/ investment)	15%	15%	5%	15%	5%	10%	5%	0%	15%	85%
3. Capacity / Supply shortfalls	15%	20%	10%	20%	60%	15%	0%	10%	25%	175%
4. Price increases (to unacceptable)	5%	5%	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	15%	80%
5. Trading Systems unavailable/ ineffective	0%	0%	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	5%	60%
6. Reputation Risk	30%	20%	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	25%	230%
7. Market Abuse	5%	10%	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	15%	120%
Sum Contributions	70%	70%	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	15%	
Percent £ budget										
Cost/Effectiveness										



But note that no one or even 2 Designs was deemed sufficient to Reach the any one value goal on its own. So a *large set of designs* seems necessary

Values express-ed as Require-ments

Requirements	Incentivise	Tea Kiosk	Daily Danger Checks	Sum
Project Timeliness Status: 10 → Wish: 5 % % time overrun necessary to deliv... Δ%: [Project Cost Size = { Medium ($10k -...] ?%: 30th June 2017	8 ± 0 -2 % 40 ± 0 % 32 % (x 0.8) 40%	5 ± 1 -5 % 100 ± 20 % 50 % (x 0.5) 100%	15 ± 8 5 % -100 ± 160 % -80 % (x 0.8) -100%	ΣΔ%: 40 ± 180 %
Building Security Status: 50 → Wish: 10 % I... % of [Emergency Types] which in ...ct... Δ%: [Emergency Types = { Earthquake }, ?%: 30th June 2018	50 ± 0 0 % Injury 0 ± 0 % 0 % (x 0.0) 0%	50 ± 0 0 % Injury 0 ± NaN % 0 % (x 0.6) 0%	30 ± 10 -20 % Injury 50 ± 25 % 15 % (x 0.3) 50%	ΣΔ%: 50 ± 25 %
User Productivity Status: 15 → Wish: 5 minutes number of minutes for a [user] to co... Δ%: [user = { adult }, ?%: task = { dri...] 30th June 2017	10 ± 0 -5 minutes 50 ± 0 % 0 % (x 0.0) 50%	8 ± 3 -7 minutes 70 ± 30 % 56 % (x 0.8) 70%	15 ± 0 0 minutes 0 ± 0 % 0 % (x 0.0) 0%	ΣΔ%: 120 ± 30 %
Sum Of Values: Σ%: Credibility - adjusted: Σ?%:	90 ± 0 % 32 %	170 ± 50 % 106 %	-50 ± 185 % -65 %	
Method Implementation Cost Status: 0 → Budget: 3m $ Total monetary cost in US Dollars fo... Δ%: [Project Cost Size = { }] ?%: 30th June 2017	500k ± 0 500k $ 17 ± 0 % 34 % (x 0.0) 17%	2m ± 0 2m $ 67 ± 0 % 134 % (x 0.0) 67%	=:1m ± 0 Δ: 1m $ Δ%: 33 ± 0 % ?%: 66 % (x 0.0) 33%	ΣΔ%: 117 ± 0 %
Sum Of Development Resources: Σ%: Credibility - adjusted: Σ?%:	17 ± 0 % 34 %	67 ± 0 % 134 %	33 ± 0 % 66 %	
Value To Cost:	5.30	2.50	-1.50	

A Cost

Very Risky

Design Sets are weak. Under 100% of theoretical estimate for Success target = Building Security Wish=10 level

Maybe enough With luck

Estimated Resources exceed Budget

Best single design, values for cost But *not* good enough *alone*

The numeric relations between Requirements and Designs.

Gilb’s Design Proposition 6.

Design to Attribute

Don’t estimate, create it
‘Design to cost’ and all other attributes
(an engineering tradition)

- **A design specification**
  - **can be *creatively* modified,**
  - **and *intentionally*, modified,**
- **by a designer,**
- **so that**
  - **its resulting attributes**
    - **(performance, resources, constraint satisfaction)**
    - **are modified to be more successful**
    - **in satisfying**

Consequences Prop. 6 DtA
Designers need to be trained to do Design to Attribute, and the attributes must be made measurable

Wonderful `Design to Cost´ experience in India

R.A. Mashelkar: Breakthrough designs for ultra-low-cost products |...
ted.com
TED Talks Engineer RA Mashelkar shares three stories of ultra-low-cost design from India that use bottom-up rethinking, and some clever engineering, to bring expensive products (cars, prosthetics) into the realm of the possible f...

https://www.ted.com/talks/r_a_mashelkar_breakthrough_designs_for_ultra_low_cost_products

There are many ways to skin a cat,
and it's remarkable how you can achieve
a single objective
with a hugely varying degree of difficulty.

One interpretation is that
Design to Cost
can be done with
hugely varying cost options

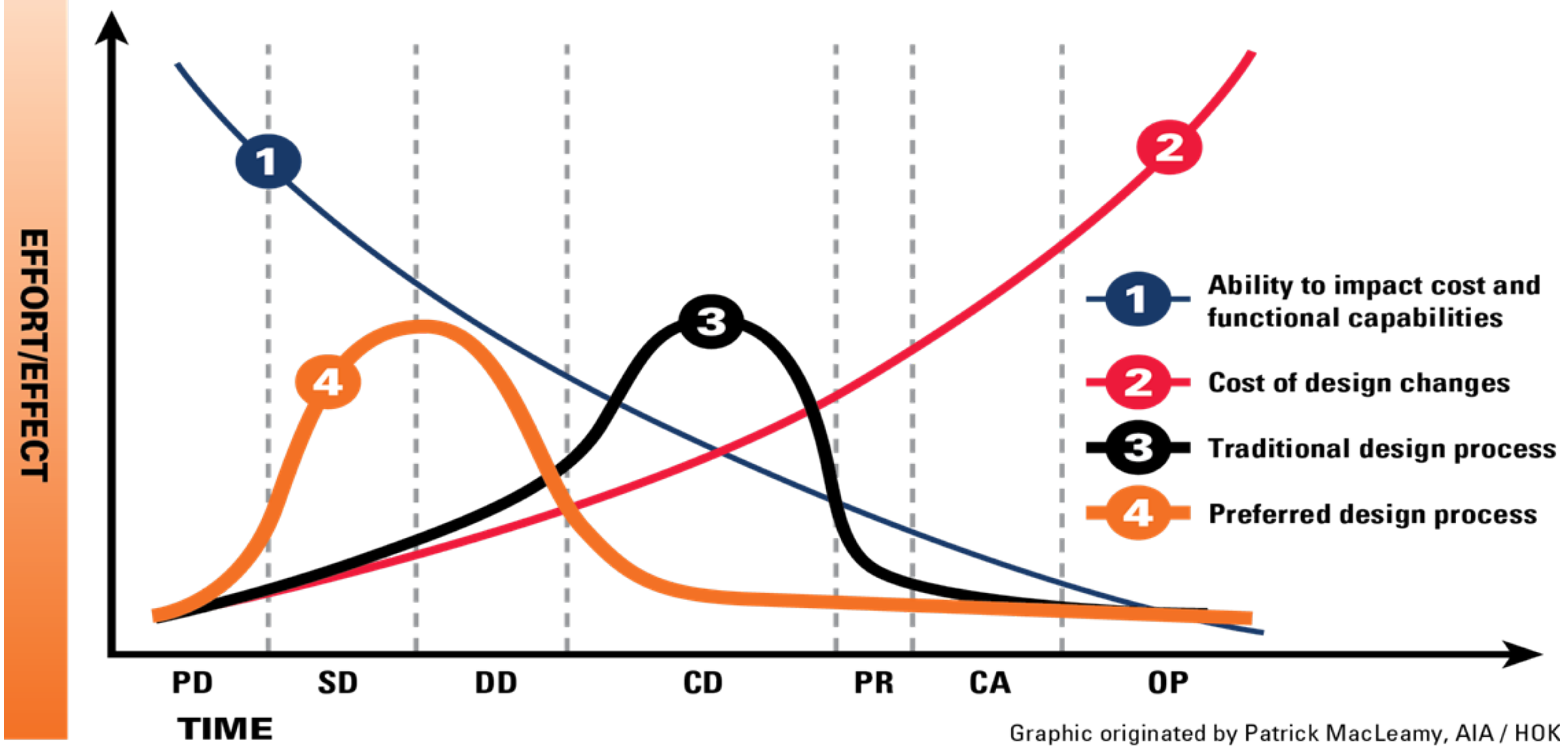
http://seekingalpha.com/article/3971543-tesla-motors-tsla-elon-reeve-musk-q1-2016-results-earnings-call-transcript?page=2

Tesla Motors (TSLA) Elon Reeve Musk on Q1 2016 Results - Earnings Transcript

May 5, 2016 12:15 AM ET

Cost of Design Changes: Construction
What about IT, or Sustainable UN Goals?

https://buildinginformationmanagement.wordpress.com/author/pcholakis/page/41/



KEY

PD: Pre-design

SD: Schematic design

CD: Construction documentation

Documentation

PR: Procurement

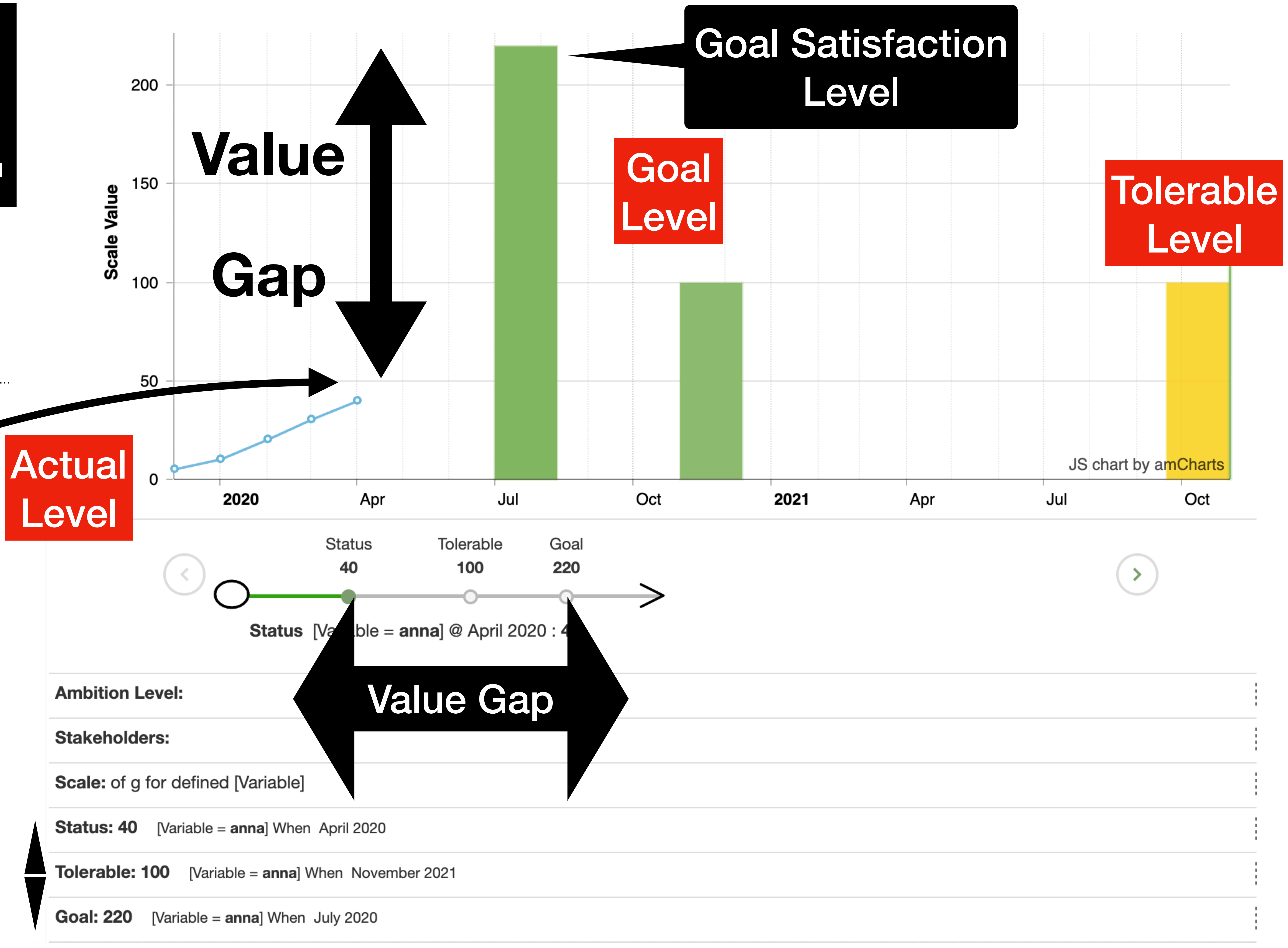
CA: Construction Administration

OP: Operation

Gilb's Design Proposition 7.
Design Satisfaction.

When is design enough design ?

- Design satisfaction occurs when,
  - first in theory,
  - later in practice,
- a set of designs
  - meets or exceeds
  - performance design-targets,
- within
  - all constraints
    - (resource budgets, and other specified constraints).



Consequence of Prop. 7
Designers need training in estimation and measurement
And incremental design testing, and design decomposition

Which impact-estimated design is clearly unacceptable because of a cost constraint? (could we re-design it to cost less?)

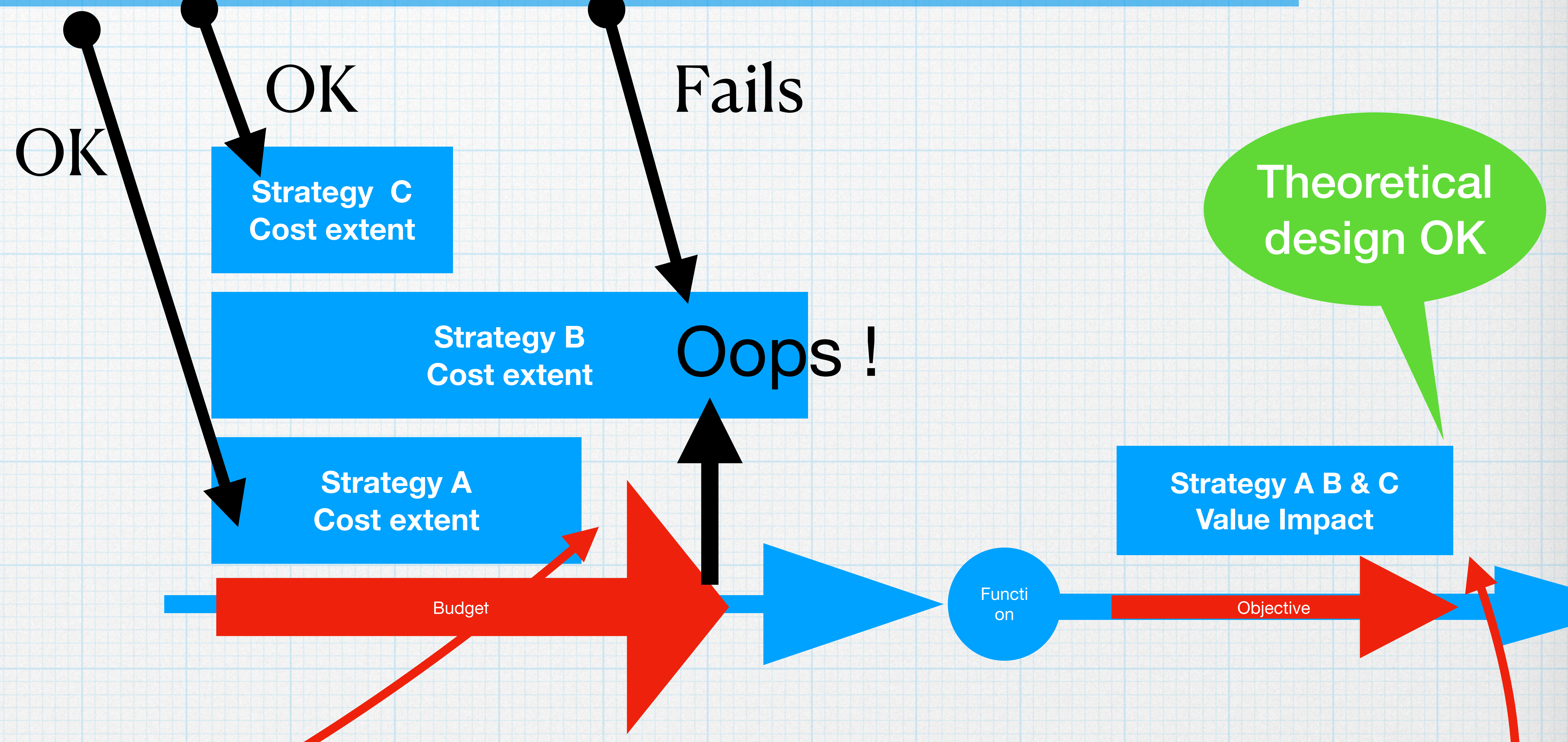
Quiz:

If A and C are within budget,

Does that mean they are

‘approved’ and can be used in the

Final design set of ideas?



(Why, maybe, NOT ?)

1. Because (costs)

2. Because (Impact)

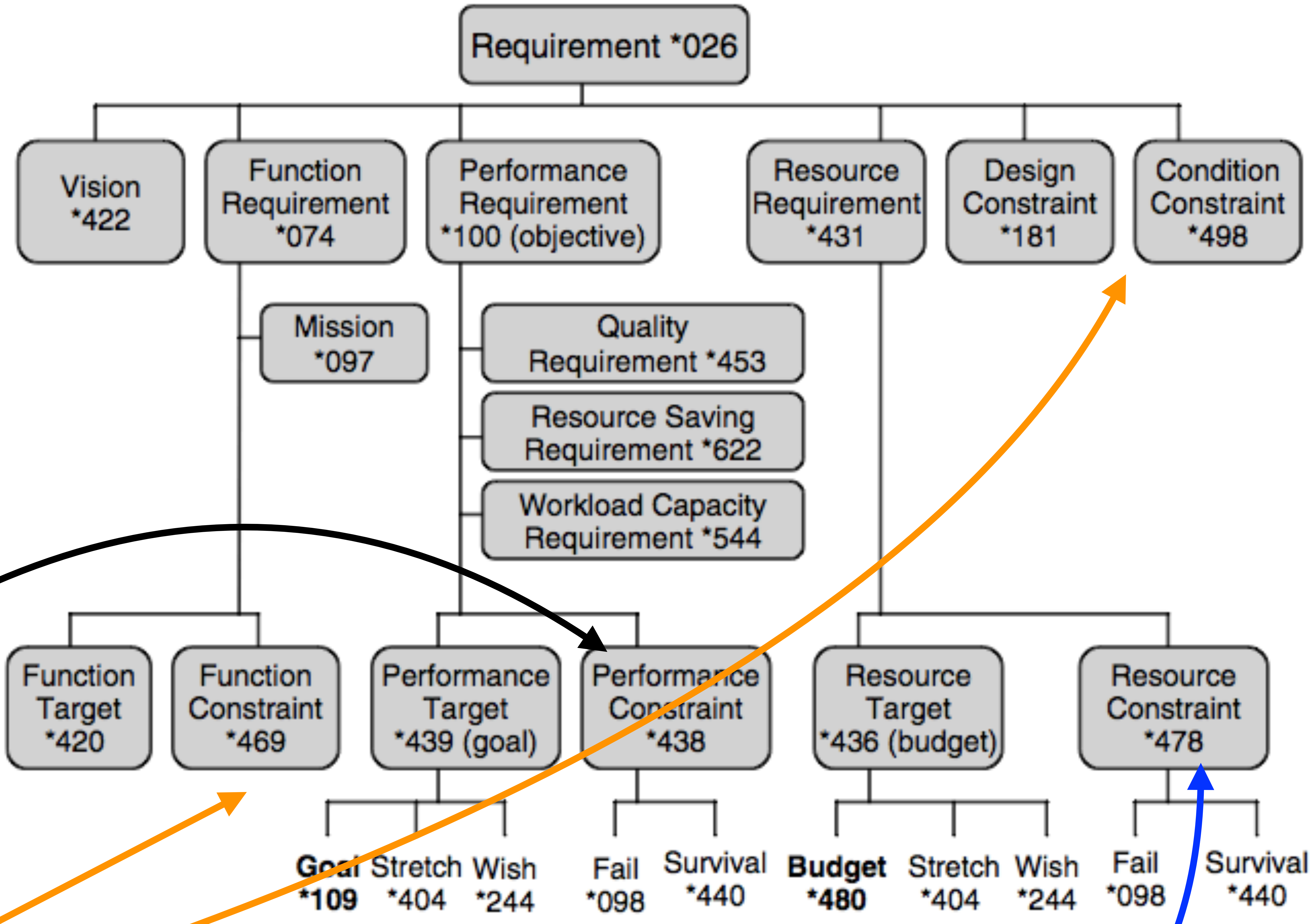
Cost-effective strategy selection
Or ‘Efficient’ strategy selection

Gilb's Design Proposition 8.

Design Survival.

Just barely, 'not-dead' design.
Define 'system failure' formally,
with numbers, on a scale.

- **Design 'Survival' occurs when:**
  - ***first* in-theory,**
  - ***later* in-practice,**
- **a set of specified designs,**
  - **meets all *worst-acceptable-case* 'specified performance levels',**
- ***without***
  - **exceeding any worst-acceptable-case *resource* budget limitations.**
  - **Or any other constraints**



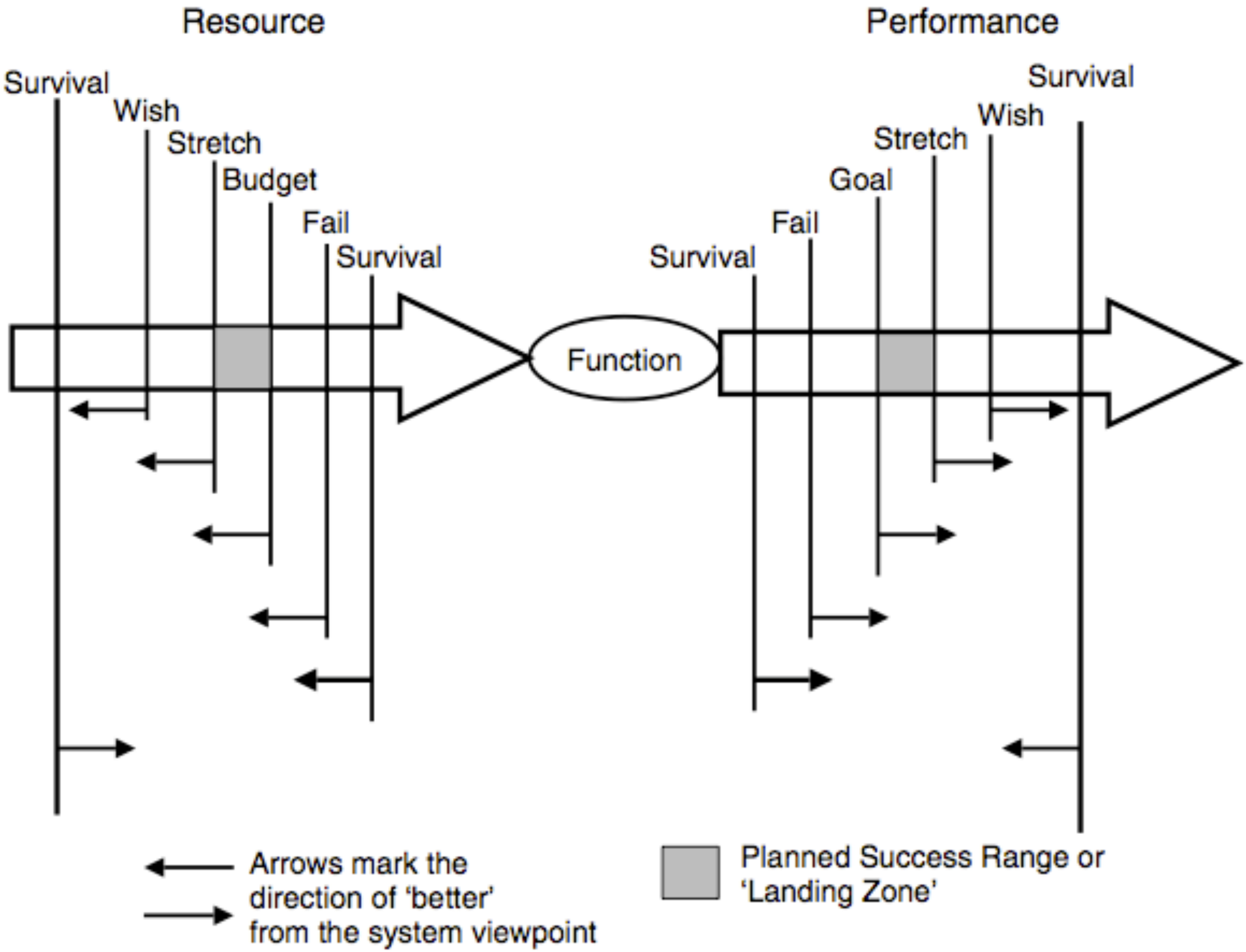
Consequence Prop. 8 Survival
Survival levels must be numerically specified.
Designers need to design towards all survival levels initially

Competitive Engineering (paper or digital 2005).
The definition of the Planguage. A Handbook and a Planguage standard.
https://www.gilb.com/p/competitive-engineering (free pdf)

Drawn Plicons with a selection of constraint levels and target levels

A variety of requirement levels to help you manage the design process

- **Plicons = Planguage Icon**
- **Plicons: A Graphic Planning Language for Systems Engineering**
- **(Plicons Paper)**
- **http://www.gilb.com/DL37**



You must 'survive' designing for
Specific sets of conditions

Three-Dimensional Design Space

Very rich and tailored design

tag:SECURITY

Ambition level:

Make Warsaw safe again, by reducing and mitigating any attacks or threats to citizens and visitors

Scale:

% Known Annual [Attack Types] having [Potential Or Real Effects] on specific [Stakeholders]

[Attack Types]	[Potential Or Real Effects]	[Stakeholders]
Fake News	Corporate System Down	Attackers
Random Lock Files	Government System Down	Client of Attackers
Denial of Service	National Services Down	Attack Individual Victims
Steal Secrets	Military Systems Down	Corporate Victims
Steal Marketing Information	...	Government Victims
Pranks or PR Security Attacks		...
...		

Here is a visualization of the design space, into which we can attempt to find suitable designs
for various requirement dimensions.
Let me call this '3D-Design Thinking'.

1. The Value or resource attribute dimension
(usually about 15 of these at top level)

2. The [Scale Parameter] Level dimension.
Usually 3 to 7 of there per Scale.

3. The Scale Parameter Condition level dimension.
About 5 to 20 of these usually.

**An illustration of the [Scale Parameter] dimensions.
There are 144 theoretical combinations of single parameters,
and we can do 2 or more at a time. I
llustration designed by anna@karlowska.pl 2019-05-28.**

Gilb's Design Proposition 9.

'Design *sensitivity*' to requirement modification.

The Butterfly Design-Effect

- The moment any **requirement** specification is **changed*****,
  - in level, timing, or constraint
-
  - there is a *risk***** that *any and all* design specifications made successfully*, *before* that,
- are, wholly or partially, **invalidated****.

* successfully: the design spec gives a 'useful' impact and cost.

** **invalidated:** might be useless design, and would need improved design-specification, to be useful again.

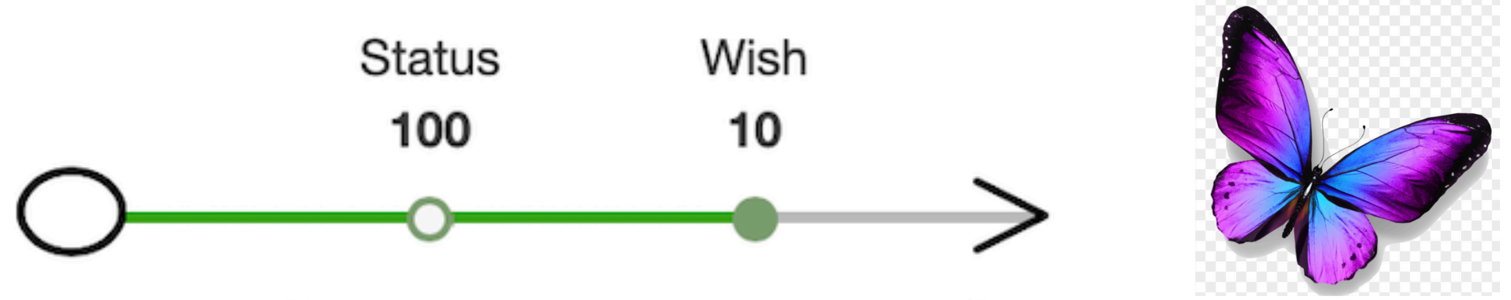
***For example, a change of '[Scale-parameter] attribute choice', see below Fig 9 A&B.

**** (a risk) not a *certainty* of invalidation. The result might *even* be 'better'.

Consequence of Prop. 9 Sensitivity
Small incremental change, measurement, and design correction.
Or, Agile as it should be.

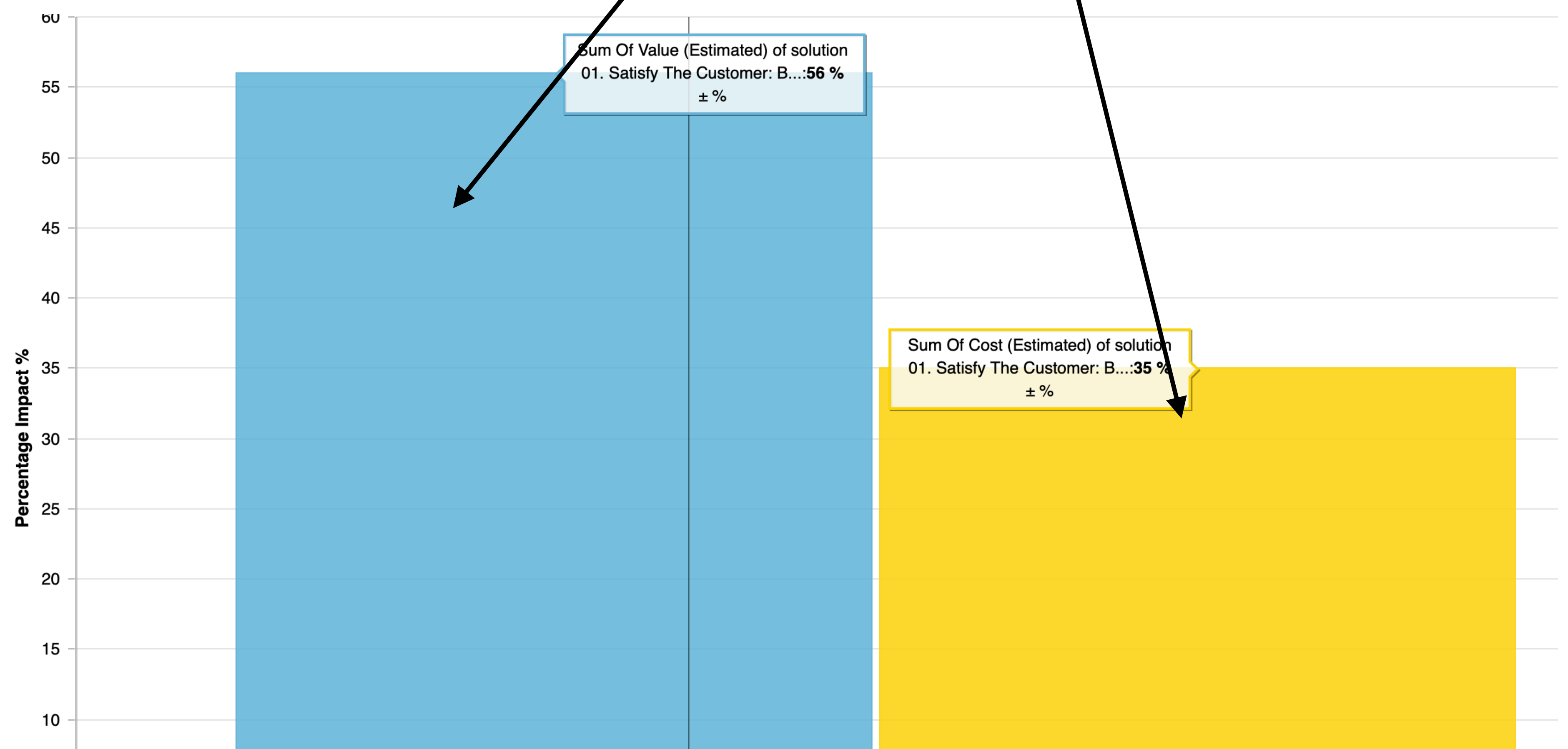
Example of Butterfly Effect (9A)

Changing

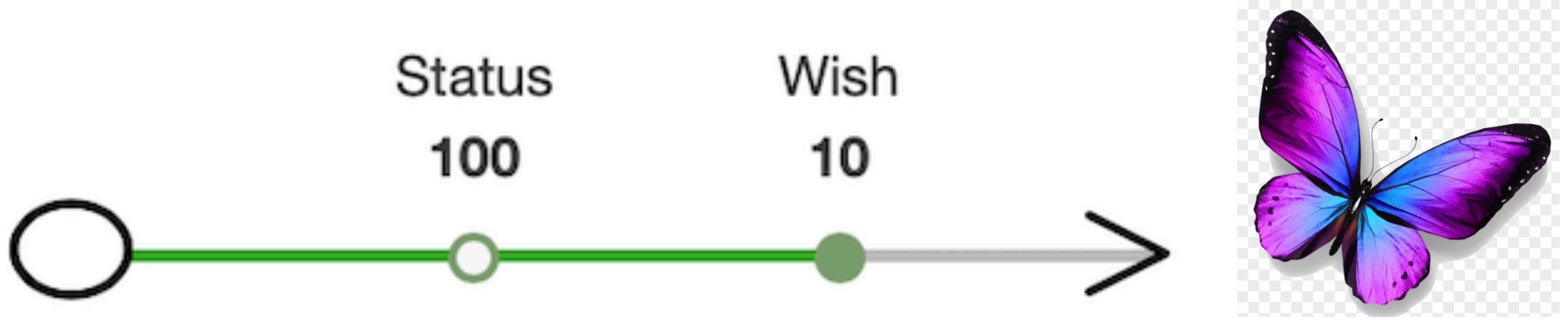


Wish [Need = **New Requirement**, Stakeholder = **{Specification Owner, All Stakeholder Representatives This Spec}**, Emerges = **Written Request**, Noted = **Entered into Digital Project Integrated System**, Project Documentation = **App.NeedsAndmeans.com**, Quality Controlled = **{Full Spec QC versus Rules, Defect Density Exit}**, Released = **All Exit Conditions Met**, Purposes = **{Project-Wide Consequences, Prioritization,Architecture Process Entry,Test Process Entry,Costs Estimation,Side Effect Evaluation}**] @ 15 Jan 2019 : **10** Response Hours <- *tom@ gilb.com*

- Figure 9A:
- **With the Requirement**
- **'Need' = 'New Requirement'**
  - **we estimated the impact of the design**
  - **to satisfy the Value**
    - **as '56%'**
    - **of the way to the Wish level.**
    - **And we estimated the cost**
      - **on the 'Budget' resource specification,**
      - **as '35%' of the Budget.**



Example (9B)



Wish [Need = **Critical Requirement**, Stakeholder = **{Specification Owner, All Stakeholder Representatives This Spec}**, Emerges = **Written Request**, Noted = **Entered into Digital Project Integrated System**, Project Documentation = **App.NeedsAndmeans.com**, Quality Controlled = **{Full Spec QC versus Rules, Defect Density Exit}**, Released = **All Exit Conditions Met**, Purposes = **{Project-Wide Consequences, Prioritization,Architecture Process Entry,Test Process Entry,Costs Estimation,Side Effect Evaluation}**] @ 15 Jan 2019 : **10** Response Hours <- *tom@ gilb.com*

- **Figure 9b:**
- **With the Requirement**
  - **'Need' ='Critical Requirement'**
  - **we estimated the impact of the design**
    - **'01. Satisfy the Customer',**
    - **to satisfy the Value**
    - **(moving from Status 100 down to 10 scale units)**
  - **as '98%' of the way to the Wish level.**

  - **And we estimated the cost on the 'Budget' resource specification, as '25%' of the Budget.**

Requirements | **01. Satisfy The C...**

1. Individuals And Interact...
Status: **100** → Wish: **10** Response H...
Hours from [Need] of [Stakeholder] [E...
[Need = **Critical Requirement**
15 Jan 2019
Δ: **-88**
Δ%: **98** %
98%

The point being that
A small butterfly change to the requirement
Can lead to large results changes,
from a design.

Sum Of Values: Σ%: **98** %

Budget %
Status: **0** → Budget: **100** $ Capital ...
$ Capital Budget
Δ: **25**
Δ%: **25** %
25%

Gilb's Design Proposition 10.

Scientific Experimental Evaluation of Multiple Designs

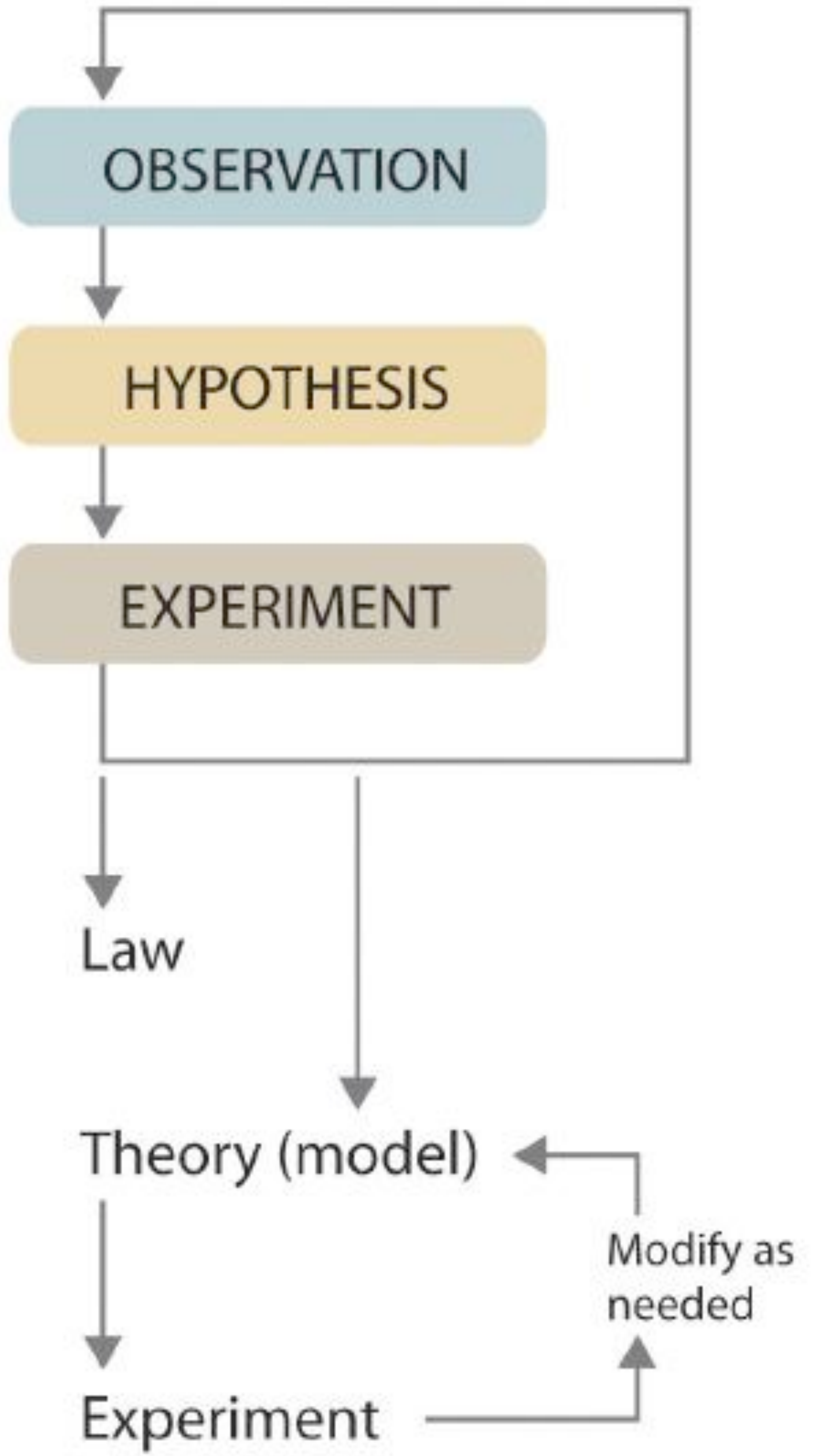
Dynamic Design-To-Value (DDTV)

- Designs are best *evaluated* (estimations);
  - **sequentially, and incrementally**
- and then also *validated* (measurements),
  - **sequentially, and incrementally,**
- so that
  - we can better understand the 'design cause'
  - of the system attribute effects.

Consequences Prop. 10

Estimations have limitations.

Measurement in small increments will tell more truth
About a complex dynamic system



Gilb's Principles of

Design Additivity.

You don't know nuttin',

- We do not know exactly the attribute states of the system,
    - which we are going to add our single design into.

- We do not know exactly
    - (or even approximately, even order-of-magnitude)
    - what will be the additive effect of incrementing a next design
        - to an unknown set of previously-implemented designs.
    - It can be useful, to try to estimate, anyway, but there is no certainty; only hope.

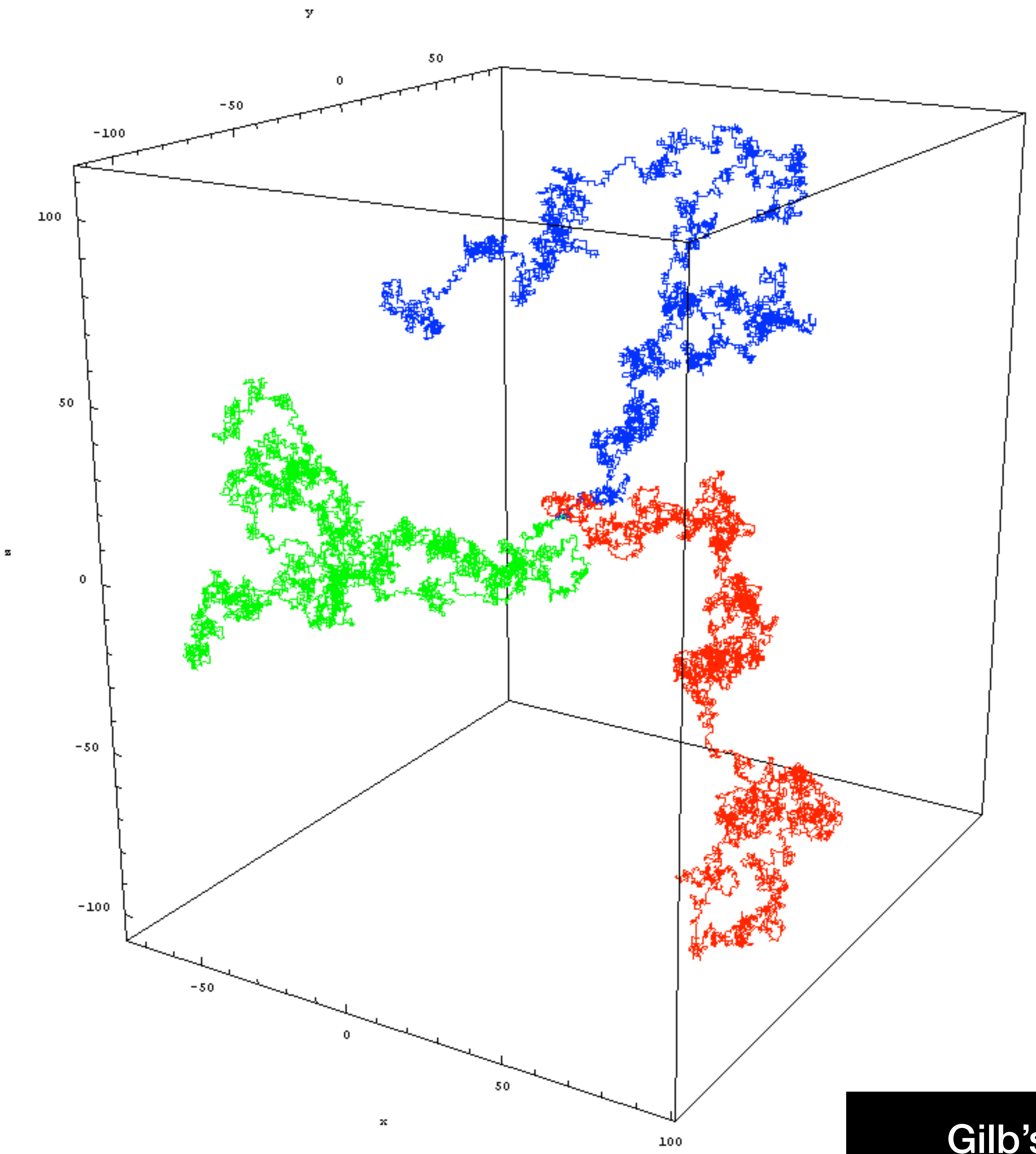
- We can *measure* the state-of-the-attributes of the incremented system,
    - *before* we implement our 'next design' increment.
    - Measurement is never *certain*, but it beats estimation.

- But there is no guarantee that this set of cumulated system attributes,
    - will be a *stable* set of attributes,
    - since they can be impacted greatly by external factors,
    - over which we have no control,
    - and even less predictive knowledge.

- We can simply add a design increment,
    - and see what happens.
    - Then we can measure the resulting attributes,
    - and possibly observe if they are stable.
    - And observe (measure) if they change,
    - when selected external and internal variables are changed.

- But we have no guarantees,
    - that a subsequent design addition
    - will not do unpredictable and negative damage
        - to any 'hard won' attribute status, observed beforehand.

These principles occur to me as general, obvious, observable, and irrefutable, with few, uninteresting exceptions. I just brainstormed them 2019-6-9. TsG



Three random walks in three dimensions

Gilb's Design Proposition 10.

Practical Example: IBM FSD

Quinnan

Quinnan describes the process-control-loop used by IBM FSD to ensure that cost targets are met.

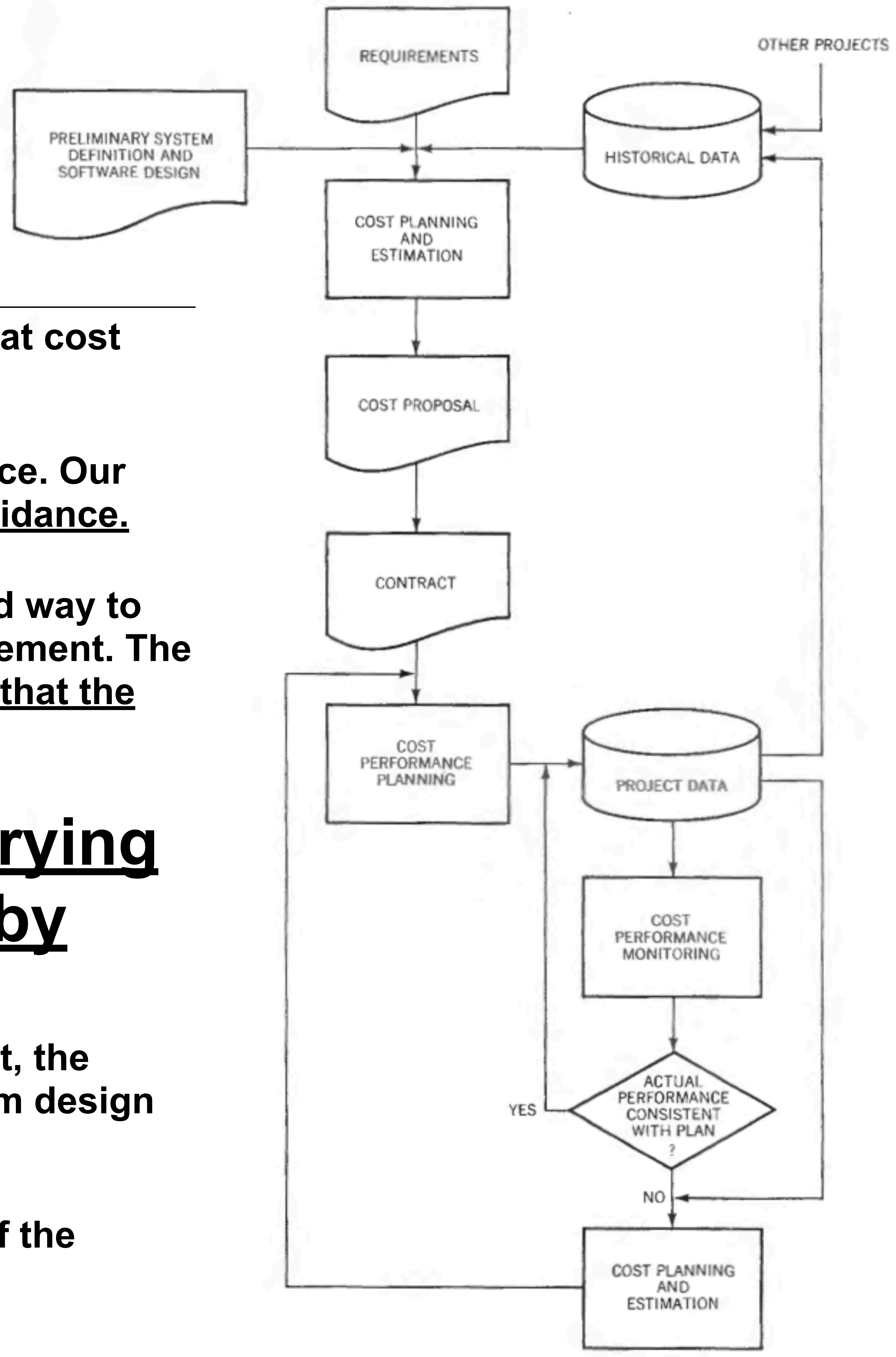
'Cost management. . . yields valid cost plans linked to technical performance. Our practice carries cost management farther by introducing <u>design-to-cost guidance.</u>

Design, development, and managerial practices are applied in an integrated way to ensure that software technical management is consistent with cost management. The method consists <u>of developing a design, estimating its cost, and ensuring that the design is cost-effective.' (p. 473)</u>

He goes on to describe **a design iteration <u>process trying to meet cost targets by either redesign or by sacrificing 'planned capability</u>.'**

When a satisfactory design at cost target is achieved for a single increment, the 'development of each increment can proceed concurrently with the program design of the others.'

'<u>Design is an iterative process </u>in which each design level is a refinement of the previous level.' (p. 474)   [11] IBM SJ 4/80



?

Cleanroom Cost Management Process

Figure 1 Cost management process

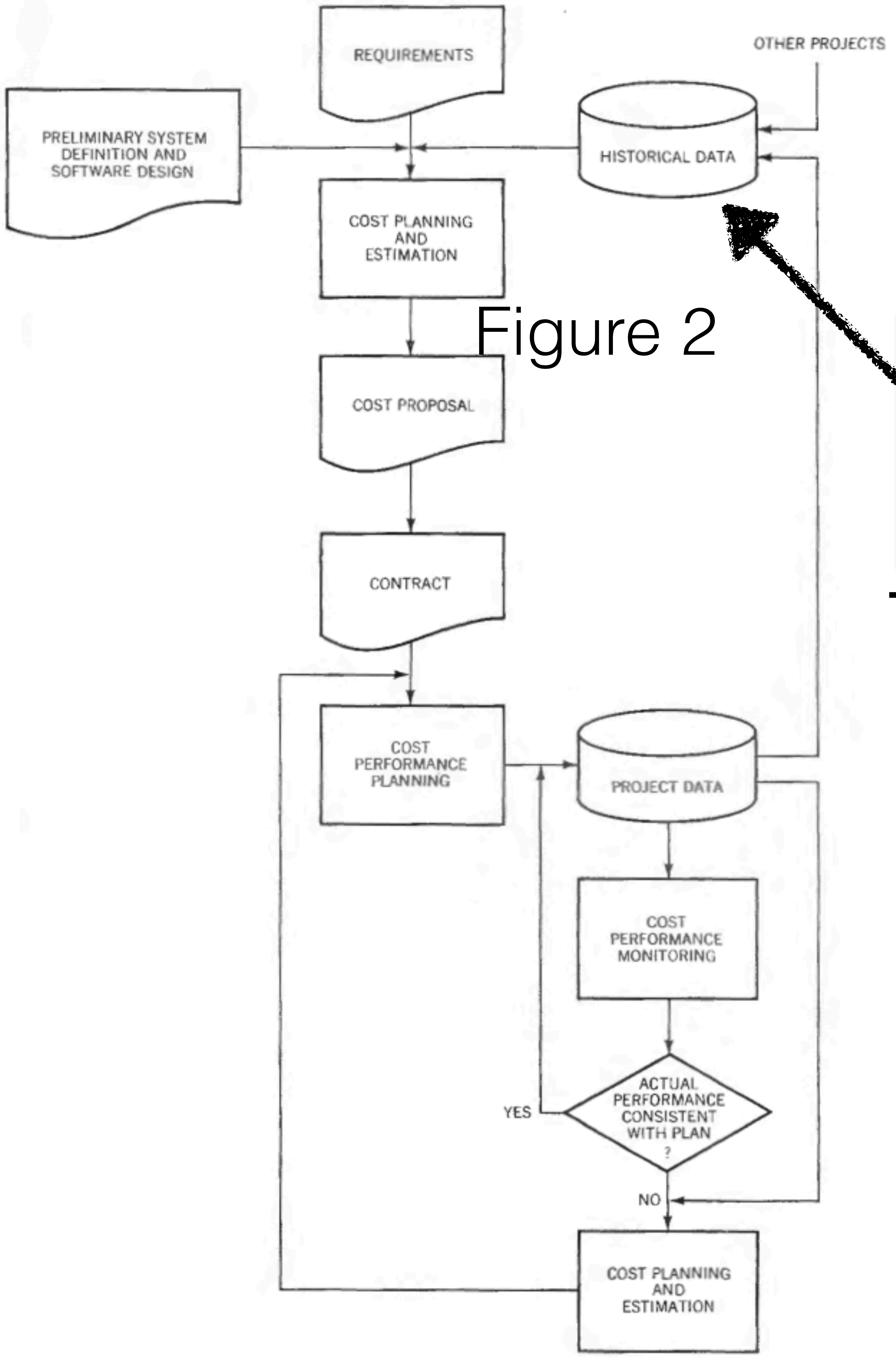
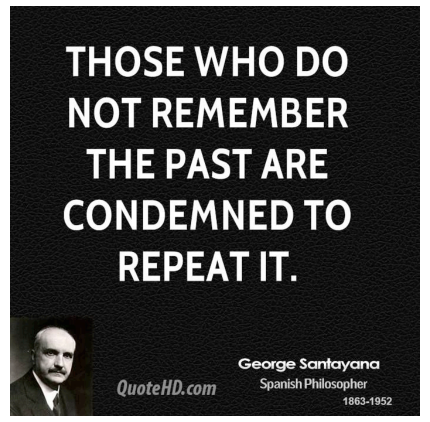


Figure 2

IBM FSD had a very advanced detailed collection
of historical data from previous projects.
Published in IBM SJ, Walston and Felix
About 20 pages of data per project were collected



Think: Fighting Covid-19 Virus by data collection

“ensuring that the design is cost effective”

Source: Quinnan, IBM SJ, page 471

http://trace.tennessee.edu/cgi/viewcontent.cgi?article=1004&context=utk_harlan

Gilb's Design Proposition 11.

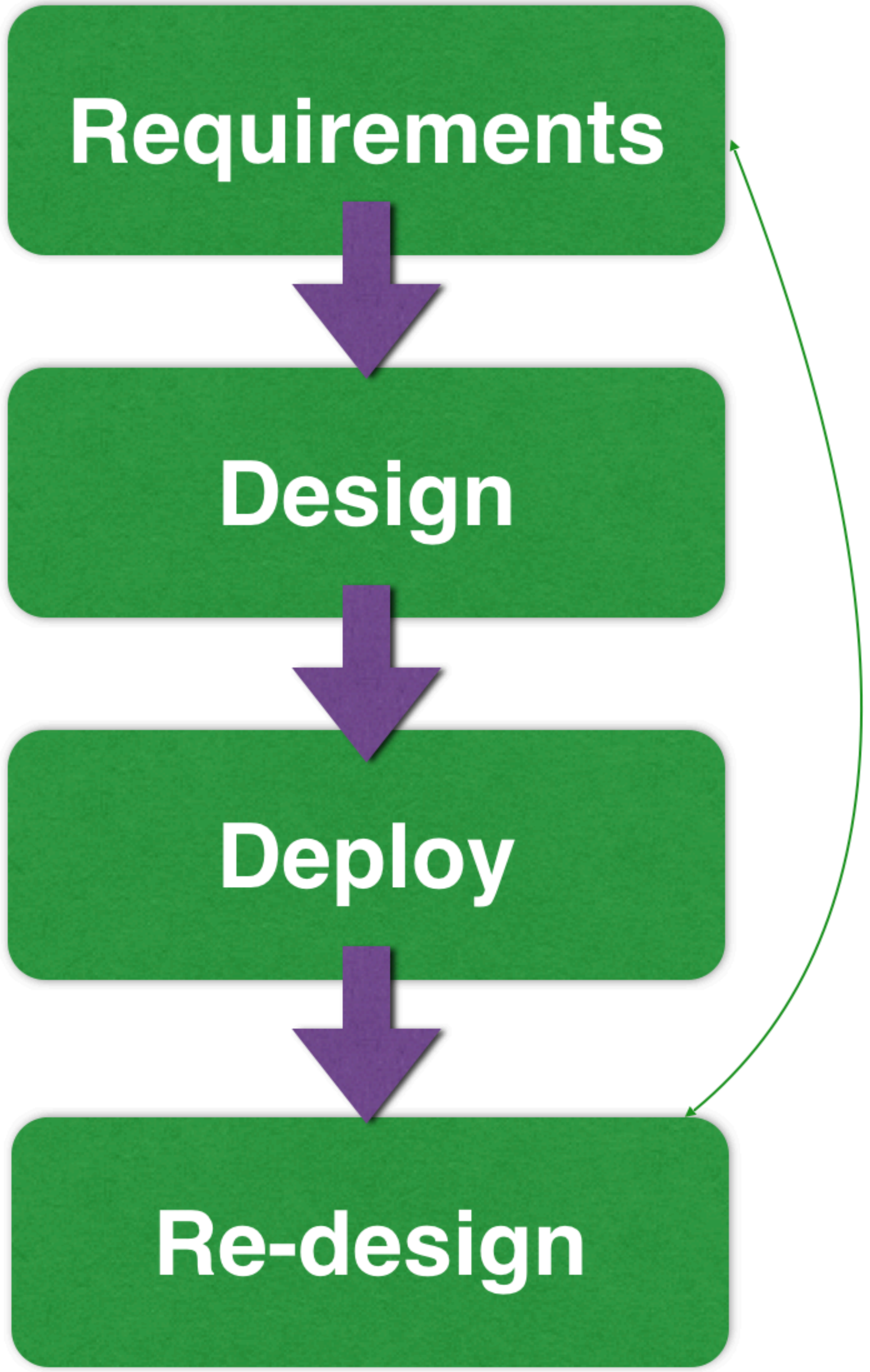
There is a logical sequence, often iterative, of analytical design-related processes, which help us find good enough designs.

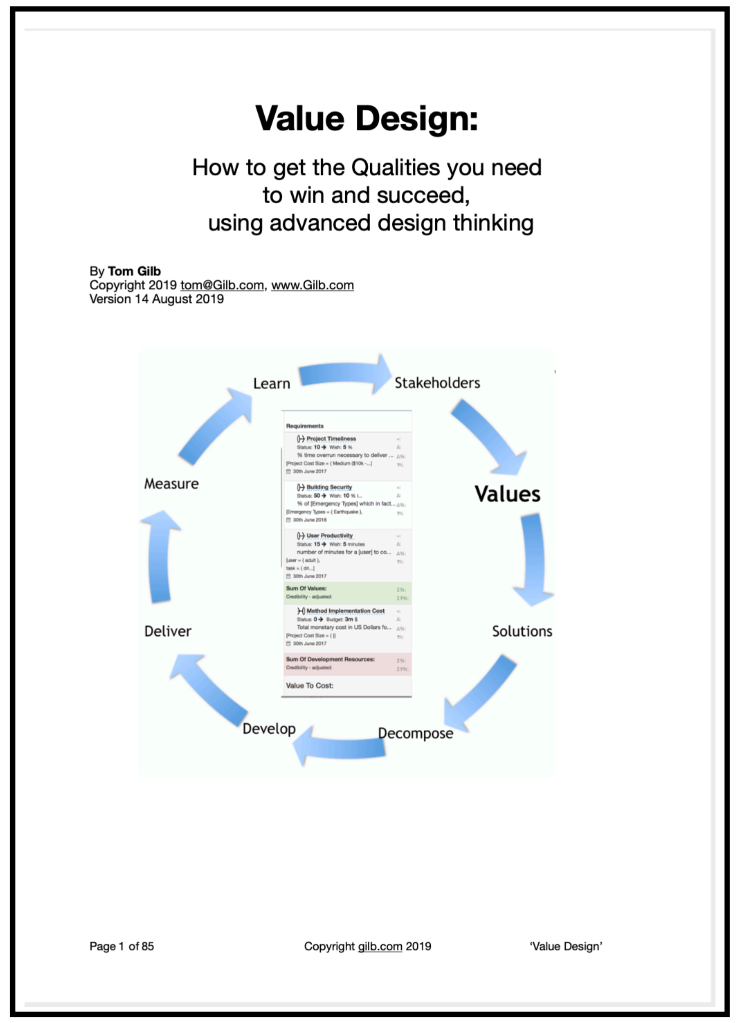
Detail ?: See
Competitive Engineering, Value Design (2019)
Value Planning, and Gilb.com

Logical Design Process

1. Environment Scope helps identify stakeholders.
2. Stakeholders have values and priorities
3. Values have many dimensions
4. Stakeholders determine value levels
5. Design hypotheses should be powerful and efficient ideas, for satisfying stakeholder needs
6. Design hypotheses can be evaluated quantitatively, with respect to all quantified objectives and resources
7. Designs can be decomposed, to find more efficient design subsets, that can be implemented early
8. Designs can be implemented sequentially, and their value-delivery, and resource costs, measured
9. Designs that unexpectedly threaten achievement of objectives, or excessive use of resources, can be removed or modified.
10. Designs that have the best set of effects on objectives, for the least consumption of limited resources, should generally be selected for early implementation.
11. A design increment can have unacceptable results, in combination with previous increments, and they, or it, might need removal or modification
12. When all objectives are reached, the process of design is complete: except for possible optimization of operational resources, by even-better design.
13. When deadlined and budgeted implementation-resources are used up, it might be reasonable to negotiate additional resources; especially if the incremental values are worth the additional resources.
14. When deadlined and budgeted implementation-resources are used up, it might be reasonable to negotiate additional resources; especially if the incremental values are worth the additional resources.The Logic of Design: Design Process Principles.

Tom Gilb, 2015, Paper. http://www.gilb.com/dl857, The Logic of Design: Design Process Principles.





Consequence of Proposition 11 Logical Design

Training, standards and QC reviews
Are needed to teach and enforce good practice
About Stakeholders, values, estimation

Principles of Design Prioritization.

1. **Design Priority**, 'the *selection* of the next design to be incremented into the system', depends on
   a. The subjective chosen viewpoint (Prioritization Policy) of the stakeholders empowered to prioritize, and
   b. The richness and quality of information about the design, and the corresponding requirements.

2. The **sequential 'next design' choice** can be computed, at each step, based on the following digital information:

a. The remaining gap in values, to scalar constraints (like 'Tolerable Levels),
b. Then when all Scalar constraints are met, the gap to Targets can be applied.
c. The remaining resources, of various types, to Budgeted level

These considerations will alert us to the needs un-met, and resources available. Opportunities and necessities.

3. Then we can **look for available design candidates** and consider the following factors:

d. The estimated value delivery, to each residual value requirement gap
e. The set of resource costs necessary to deliver that design, compared to remaining resources.
f. The set of values-to-resources ratio: relative 'efficiency' or 'profitability' of the choice.
g. The worst-case uncertainty: the lowest value levels, the highest cost levels.
h. The credibility level (0.0 to 1.0) based on estimation evidence and source quality.

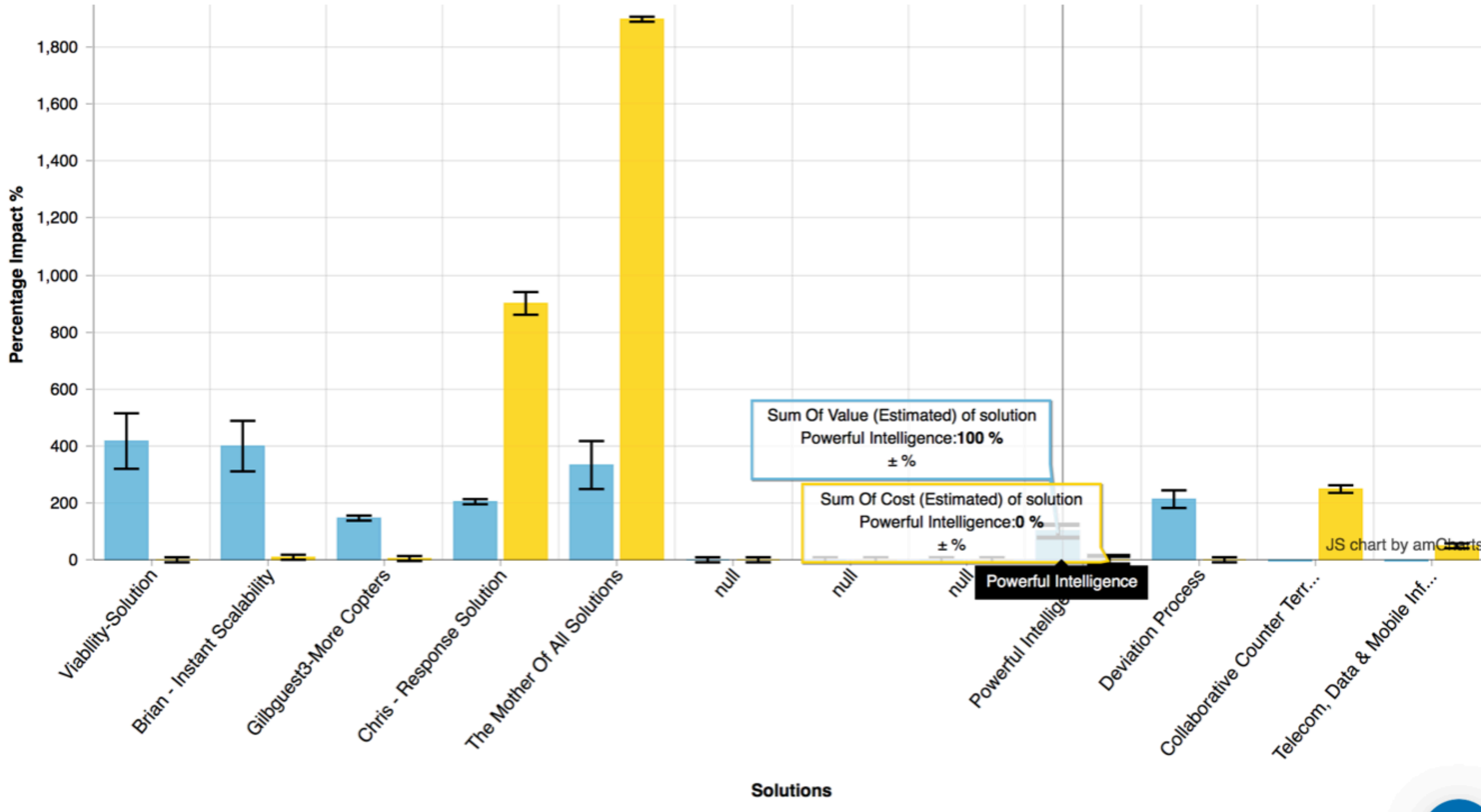
3. An important idea, different from conventional thinking about priorities [16A], is that *design priorities are not at all fixed or static*. They are highly dynamic, subject to re-determination in real time, based on the many factors above. And the changing nature of the many factors.

Gilb's Design Proposition 12.

The priority of alternative designs
can be determined
by a variety of prioritization policies;

most of which are based on objective
'values for resources',
with regard to risk.

Priority Policy Proposition



Prop. 12 Consequence
CTO might like to decide their design prioritisation Policy

End slide

- Questions and Discussion for 15 minutes

- Or whatever is left

- Or, discuss and question at

- tom@Gilb.com

Pictures from Spring edition of the Masterclass
5 / 41

38 slides, 15 minutes, 12 Propositions

15 x 60 =900 seconds

900/38 slides = 24 seconds per slides

Or

900/12 = 75 seconds per Proposition

proposition | prɒpəˈzɪʃ(ə)n |
noun
1 a statement or assertion that expresses a judgement or opinion: *the proposition that high taxation is undesirable*.
• *Logic* a statement that expresses a concept that can be true or false.
• *Mathematics* a formal statement of a theorem or problem, typically including the demonstration.