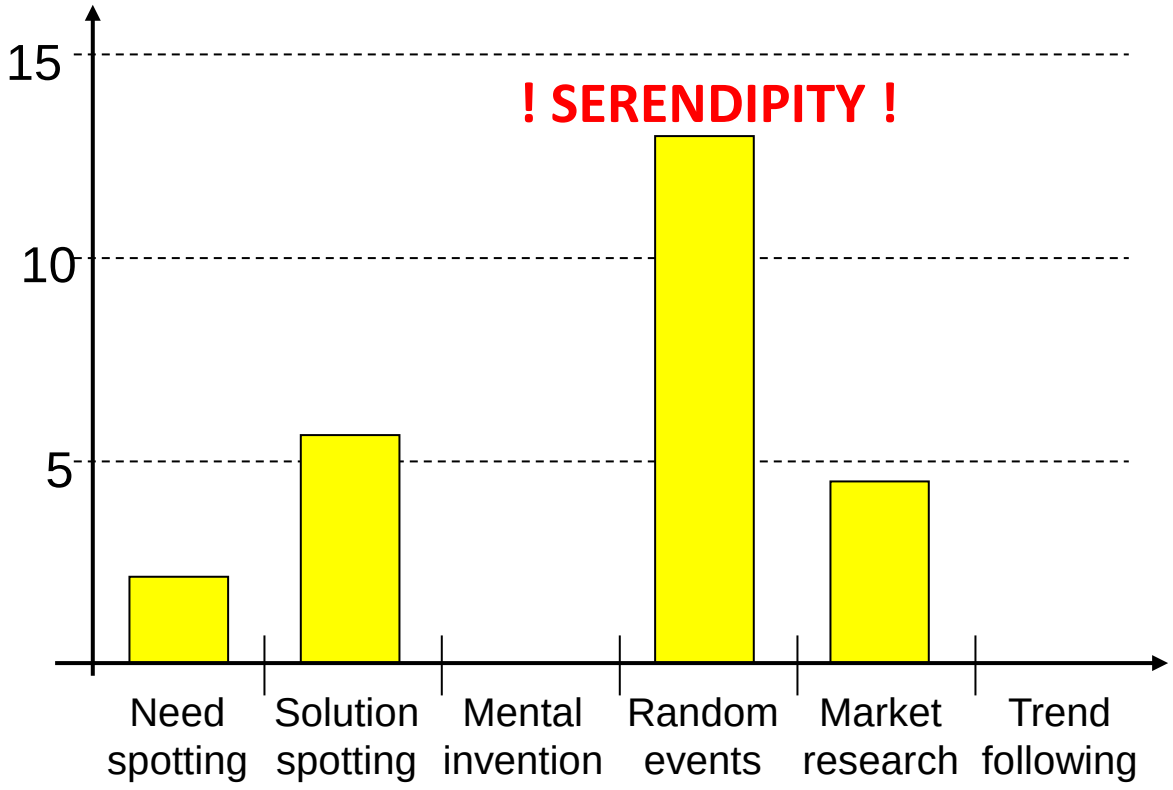
Wait for the UNEXPECTED



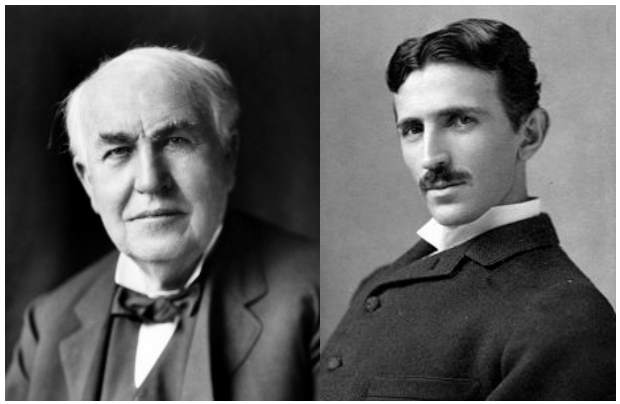
Goldenberg, J., Lehmann, D. and Mazursky, D., (2001), The Idea Itself and the Circumstances of Its Emergence as Predictors of New Product Success, Management Science 47, n.1: 69-84.

But I can not

build a shower for enhancing innovation

offer you a beer and let you talk with your friends

ask Thomas and Nicolas for advices



Am I right? I'm not affirming that you'll develop a successful product, but for sure you can patent something not patented yet.

Design around = Inventing around

- An **invention*** means an idea of an inventor which permits in practice **the solution** to a **specific problem** in the field of technology (Golzio).
- Don't be **creative** in reading: you may wrongly attribute merits to the invention (Golzio).

- Tomorrow someone will **invent** something not patented yet and our goal is to **patent** **it today**.

* from Malaysian Patent Act

How to make it possible?

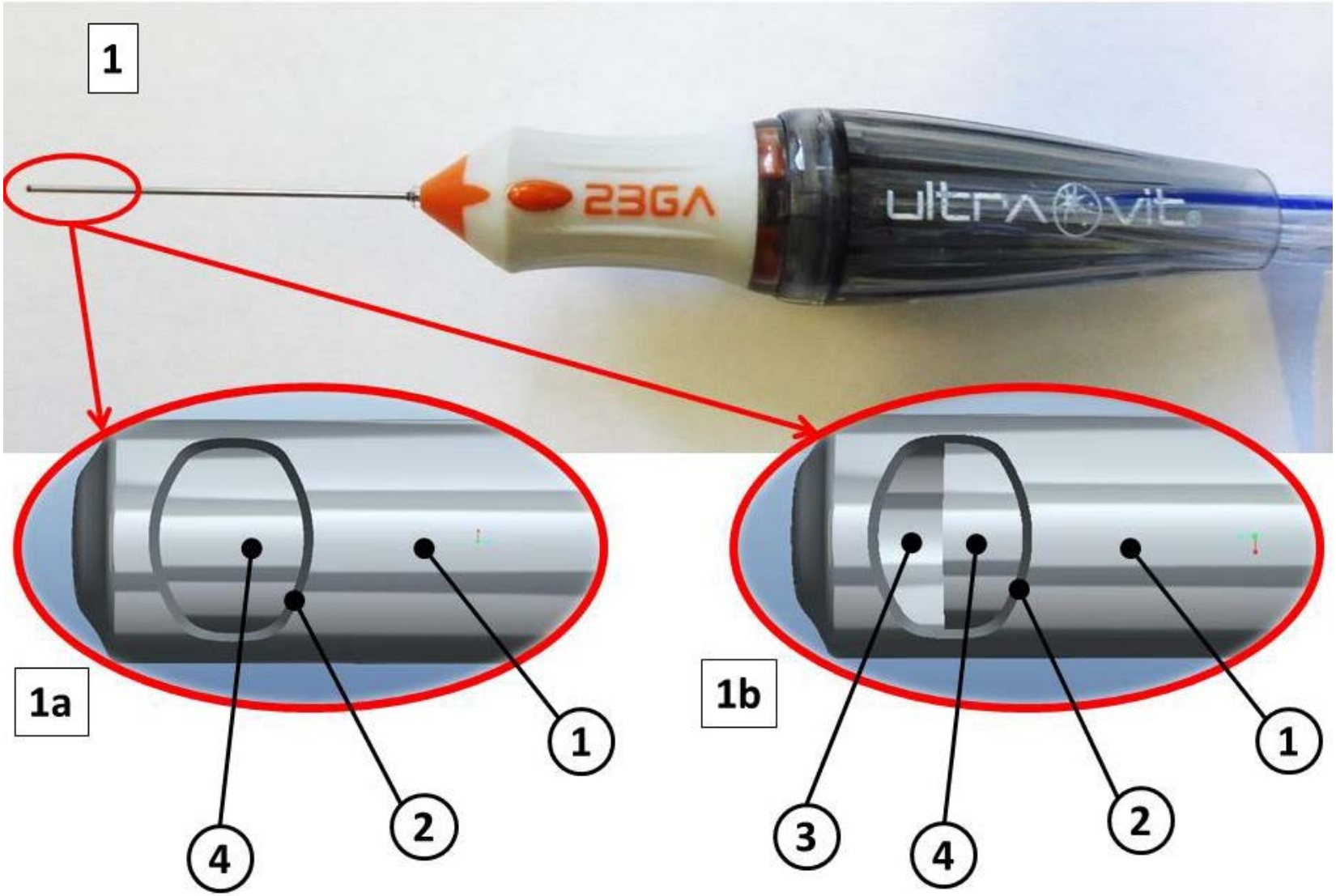
- «Creativity as an exact science». Altshuller → 40 Inventive principles.
- Formalizing problems to find analogical solutions.
- Euristics (*eu*=good+ *risko*=to find).
  - Functional reasoning.
  - Nine screens.

Case study*

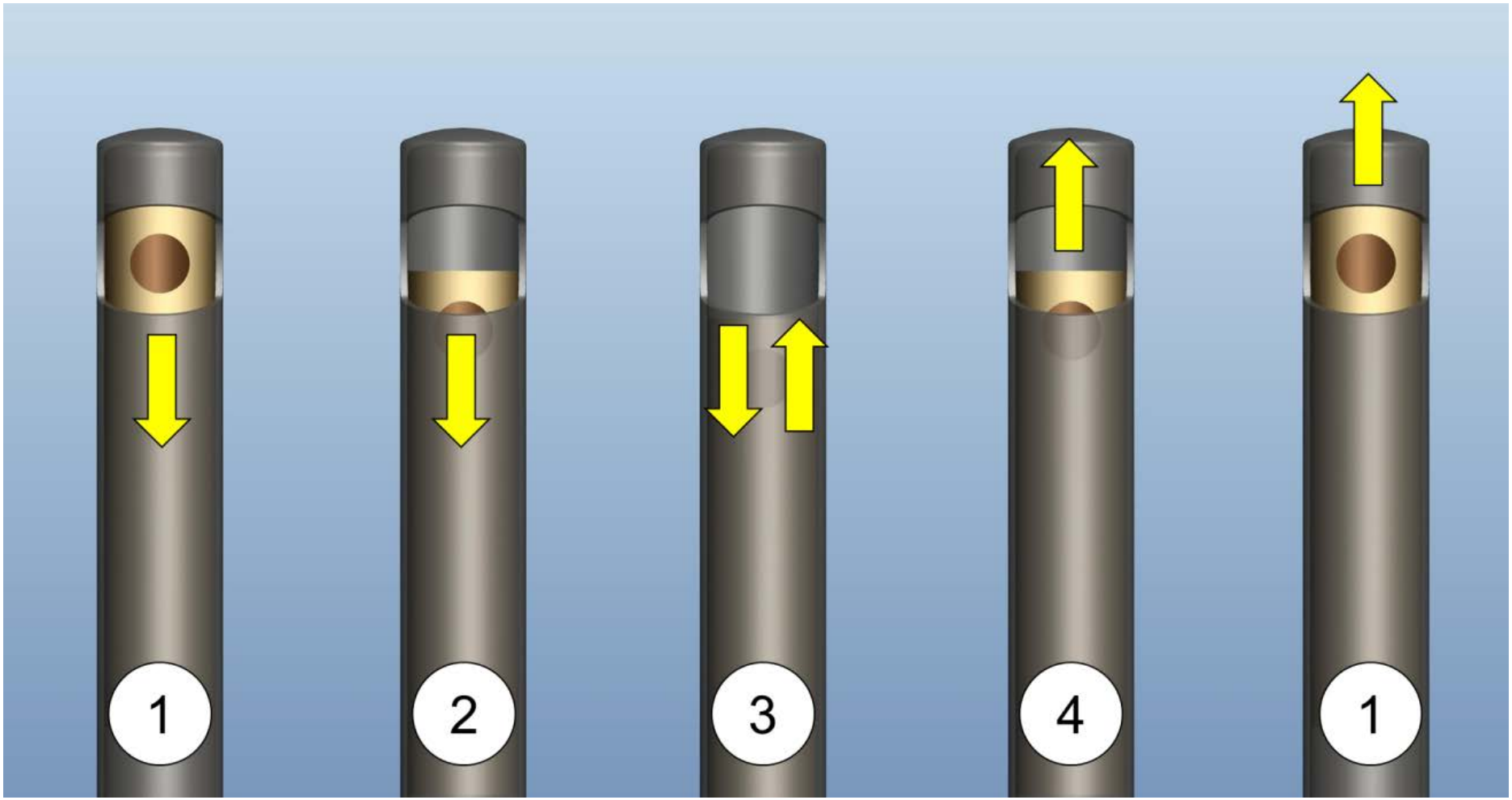
- 2011, Prof. S. Rizzo asked us to create a hole in a vitrectomy probe to increase the vitreous flow → it implies 2 consequences:
  - It makes possible a further reduction of probe size still maintaining interesting flows.
  - It allows the surgeon to decrease the surgery time.
- But something new was hidden/embedded in the solution..

* The only case we are authorized to disclose

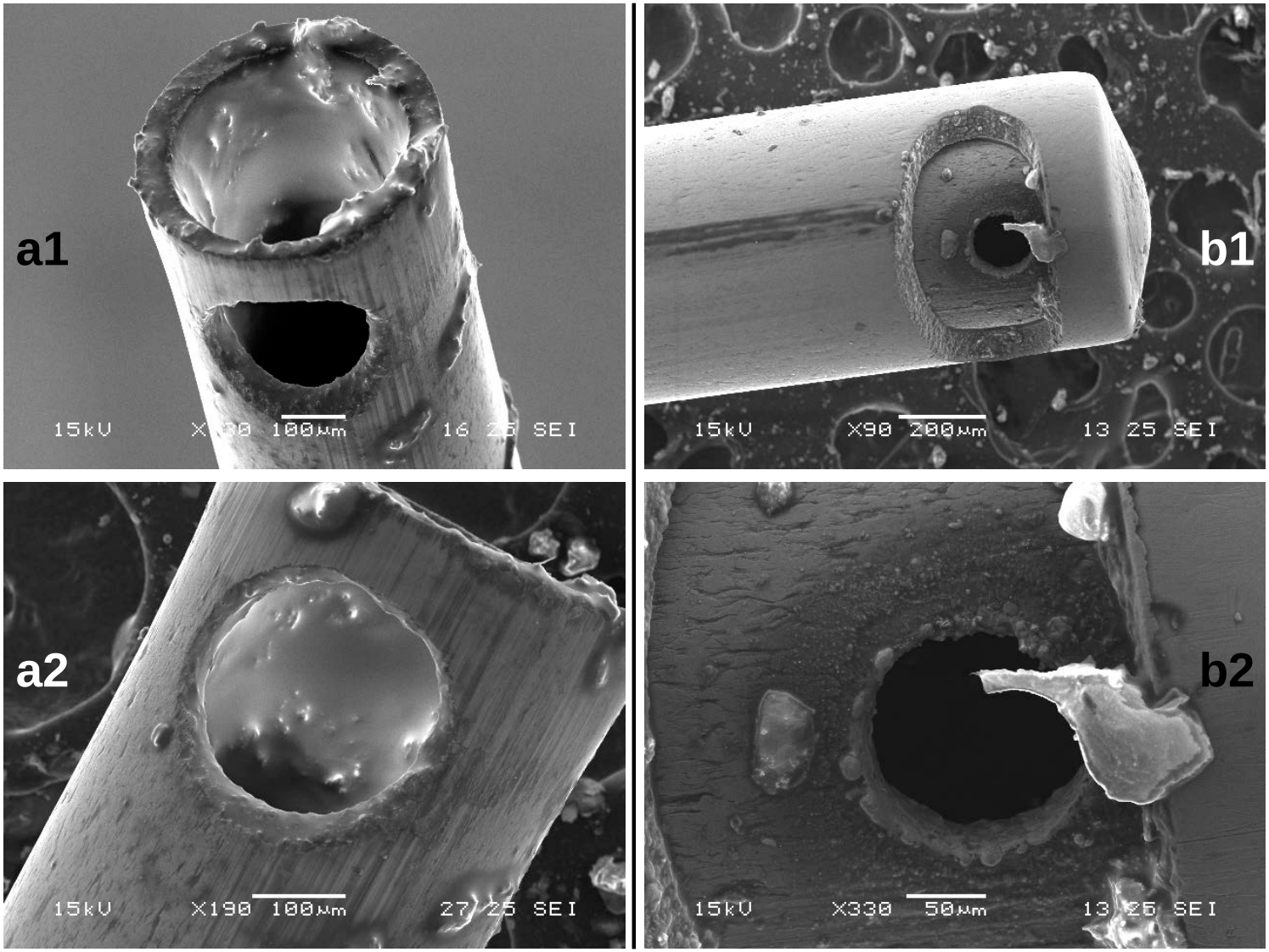
How does the vitrectomy probe work?



The idea to be developed



The manufactured vitrectomy probes



… but

- Hayafuji et al., 1992, US005106364A

Fig. 3

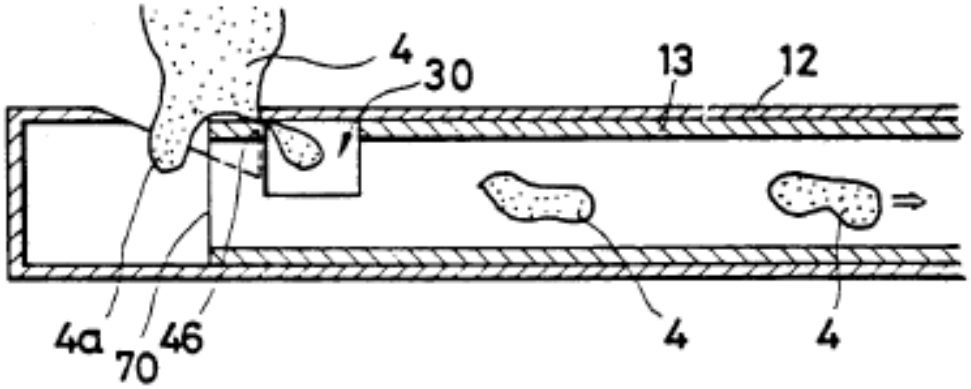
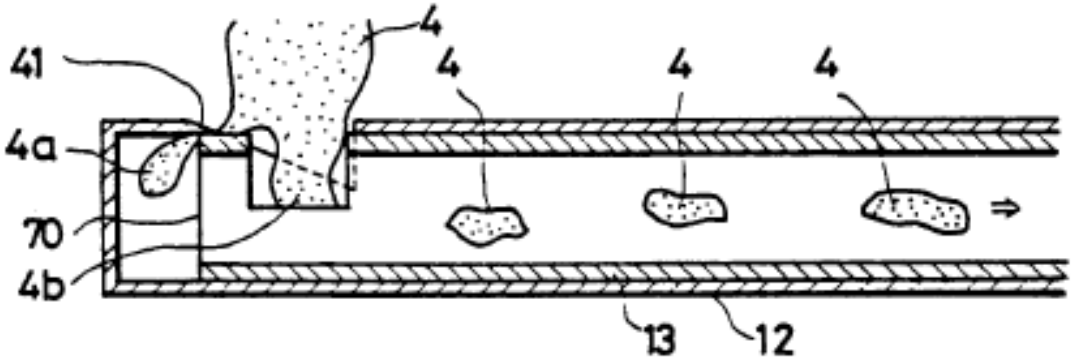


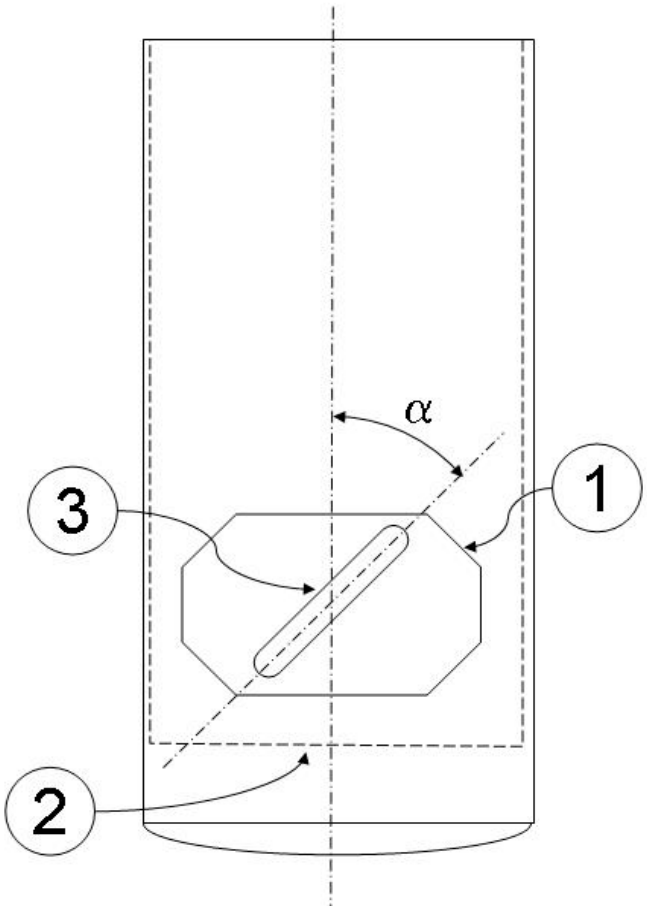
Fig. 4



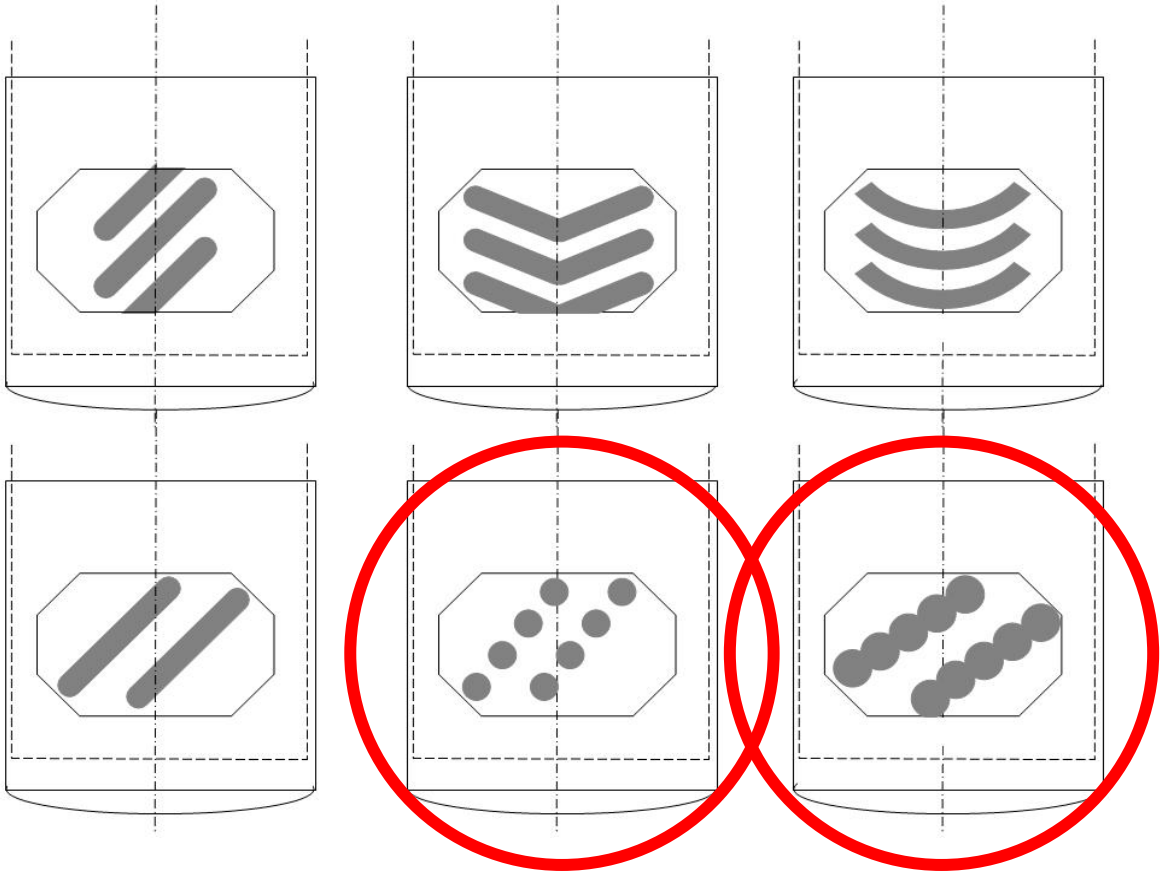
However…

- From 2011 at least 10 research groups all around the world started playing with the hole in the guillotine
- The Doheny Vision Research Center, Los Angeles, CA asked for 4 probes.
- The results were interesting: the traction of the retina reduced by 30%! What was happening?

A new solution (IT2012, PTC2013)



morphological variants
but with functional reasons



The story is even more complex since..

- In the meanwhile Geuder WO 2012059092A1 patented a device with priority 05/11/2010 where

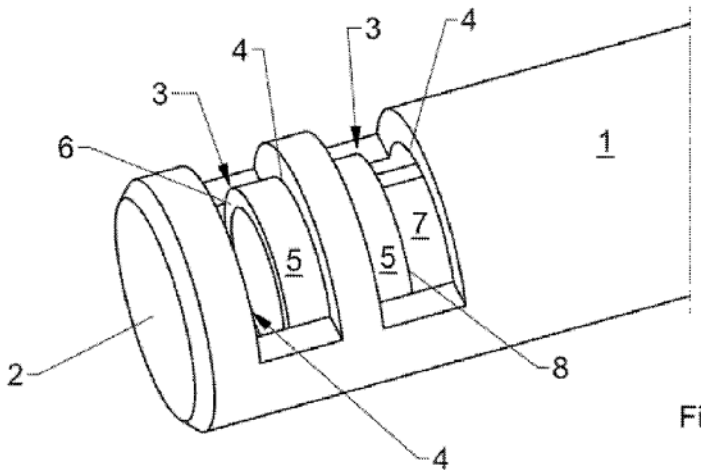
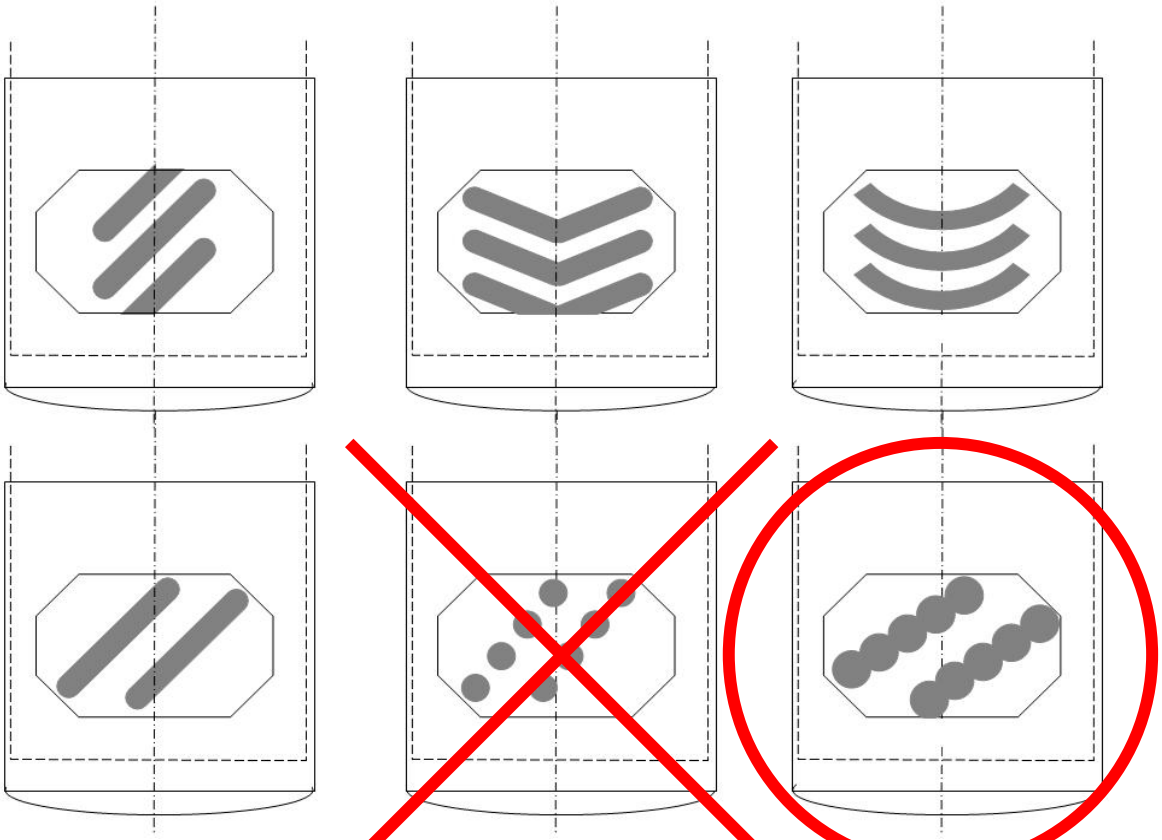


Fig. 7

«… the cutting edge of the inner tube have a different angle with respect to the longitudinal axis than the cutting edges of the outer tube. […] the stroke movement of the inner tube results in a type of scissor effect with respect to the cutting edges …»



Humayun's Provisional

Really high performances

Alcon (Irvine, CA) bought 30 modified probes (28k$),
Acon (Milano, IT) will (hopefully) donate 25k€ to continue studies and tests

Research/inventing questions

- What will be the next probe?
  - Which need has to be addressed?

    @Surgeon, patient, hospital, manufacturer level
  - How to improve the probe performance?
    - Reducing the size
    - Increasing the probe use (it is a disposable!)
    - Reducing the cost
  - Old ideas now becoming true (reinventing around!)

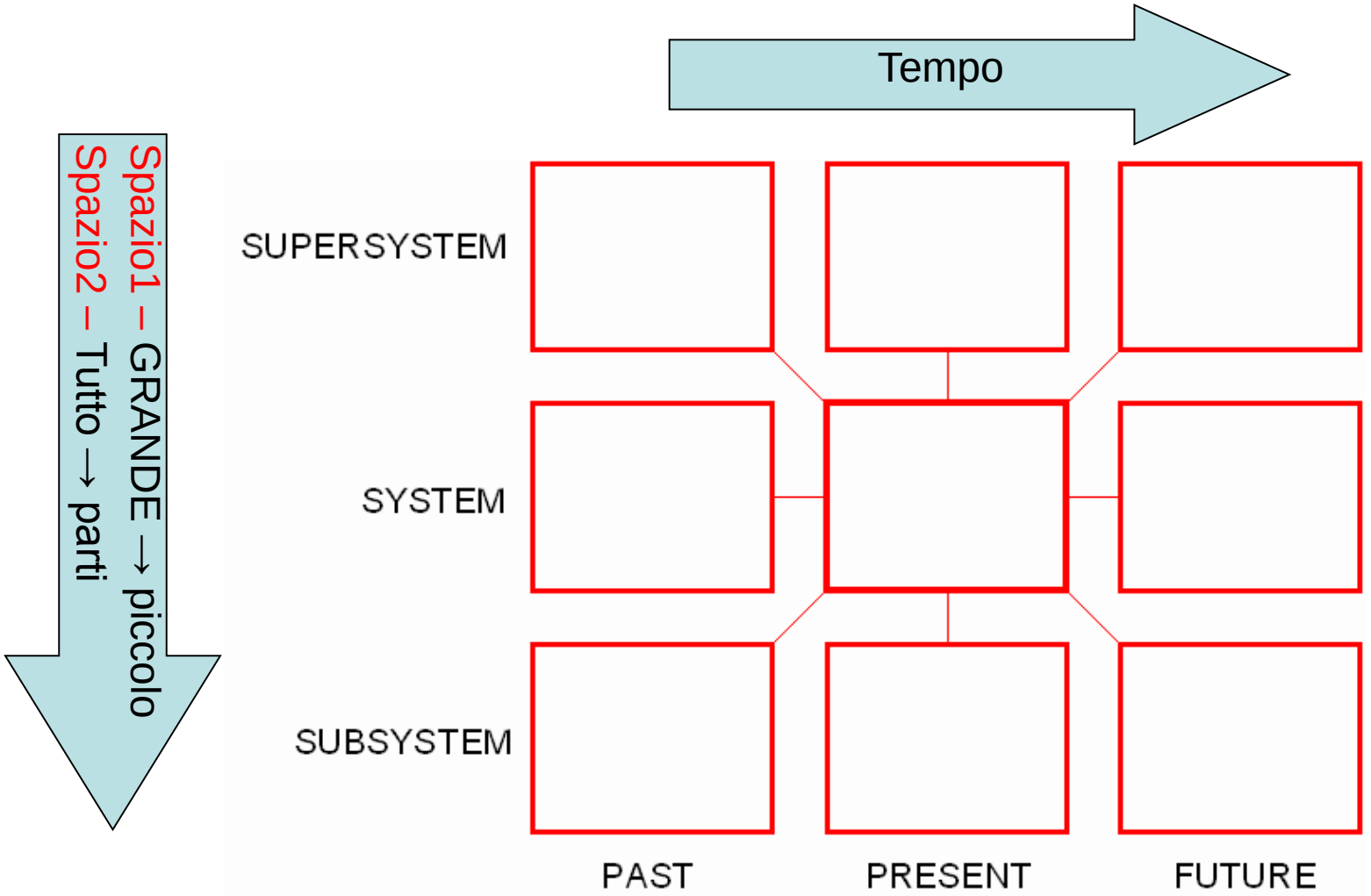
Euristics: three examples

9 Screens

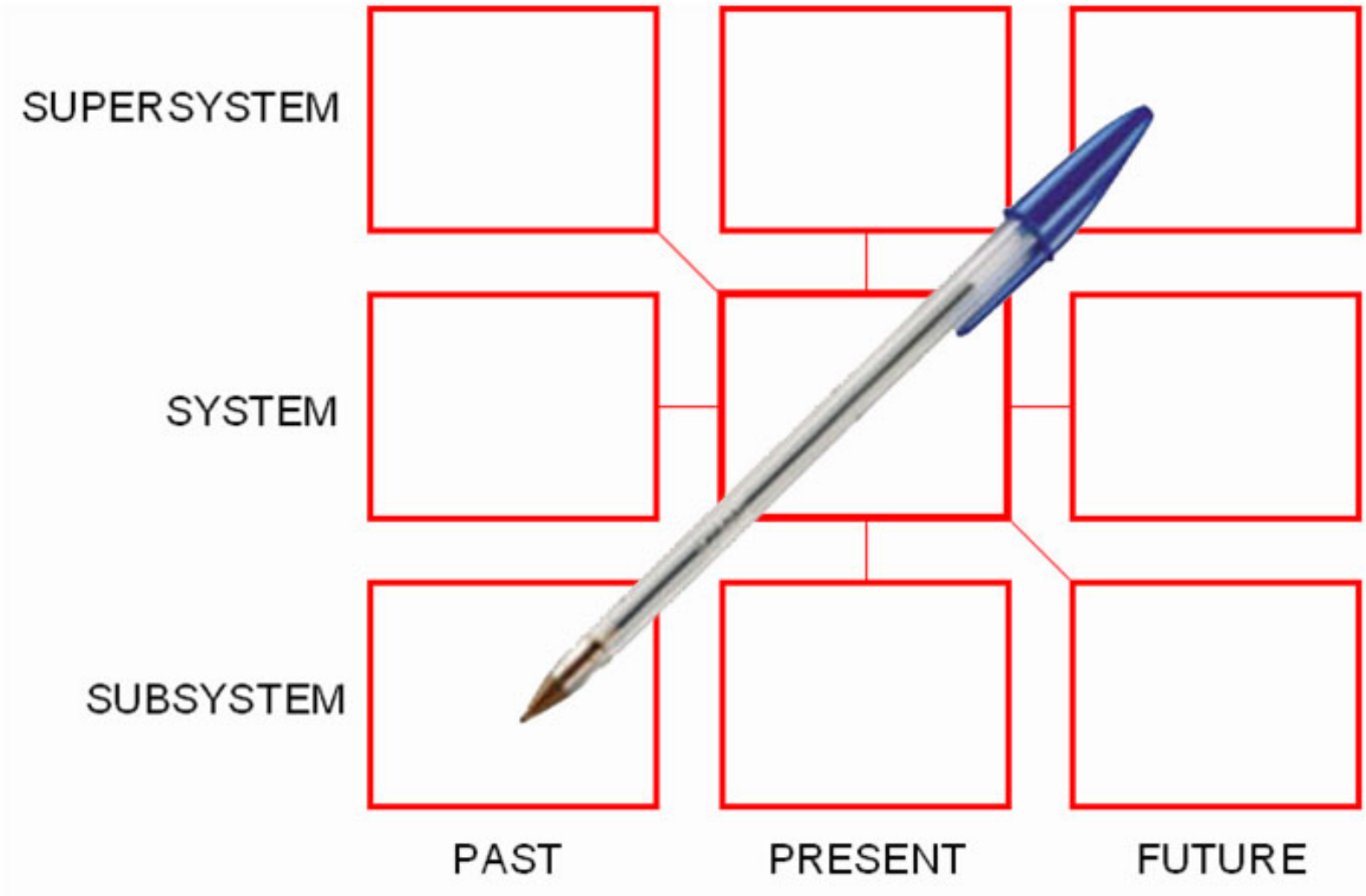
Functional Variants

Analogical Reasoning in FBS space

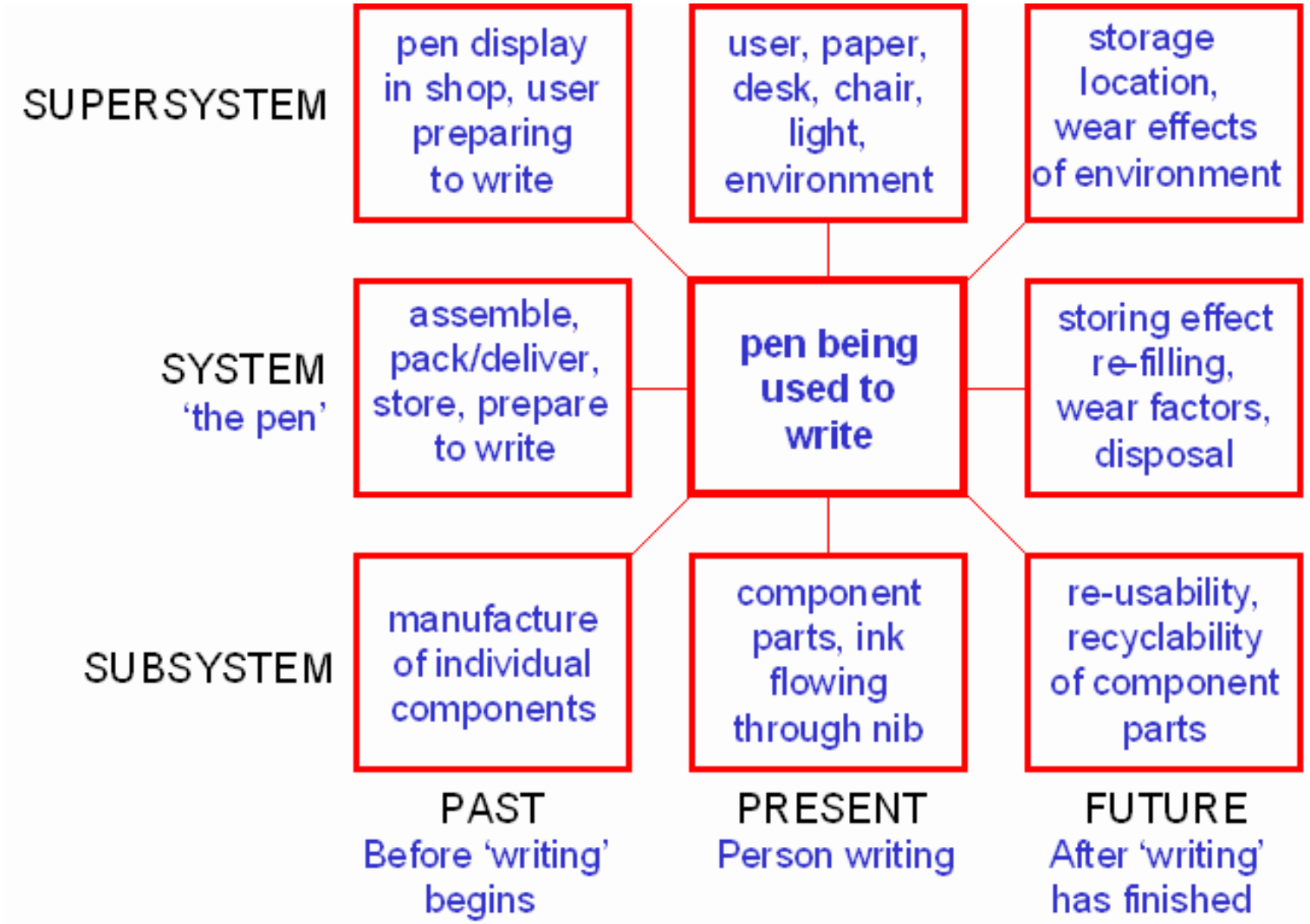
Euristiche – i 9 quadrati



Euristiche – i 9 quadrati



Euristiche – i 9 quadrati



Ricerca di varianti funzionali

Innoviamo un oggetto “banale”

?

Ricerca di varianti funzionali

“PULIRE POLVERE/SPORCO”

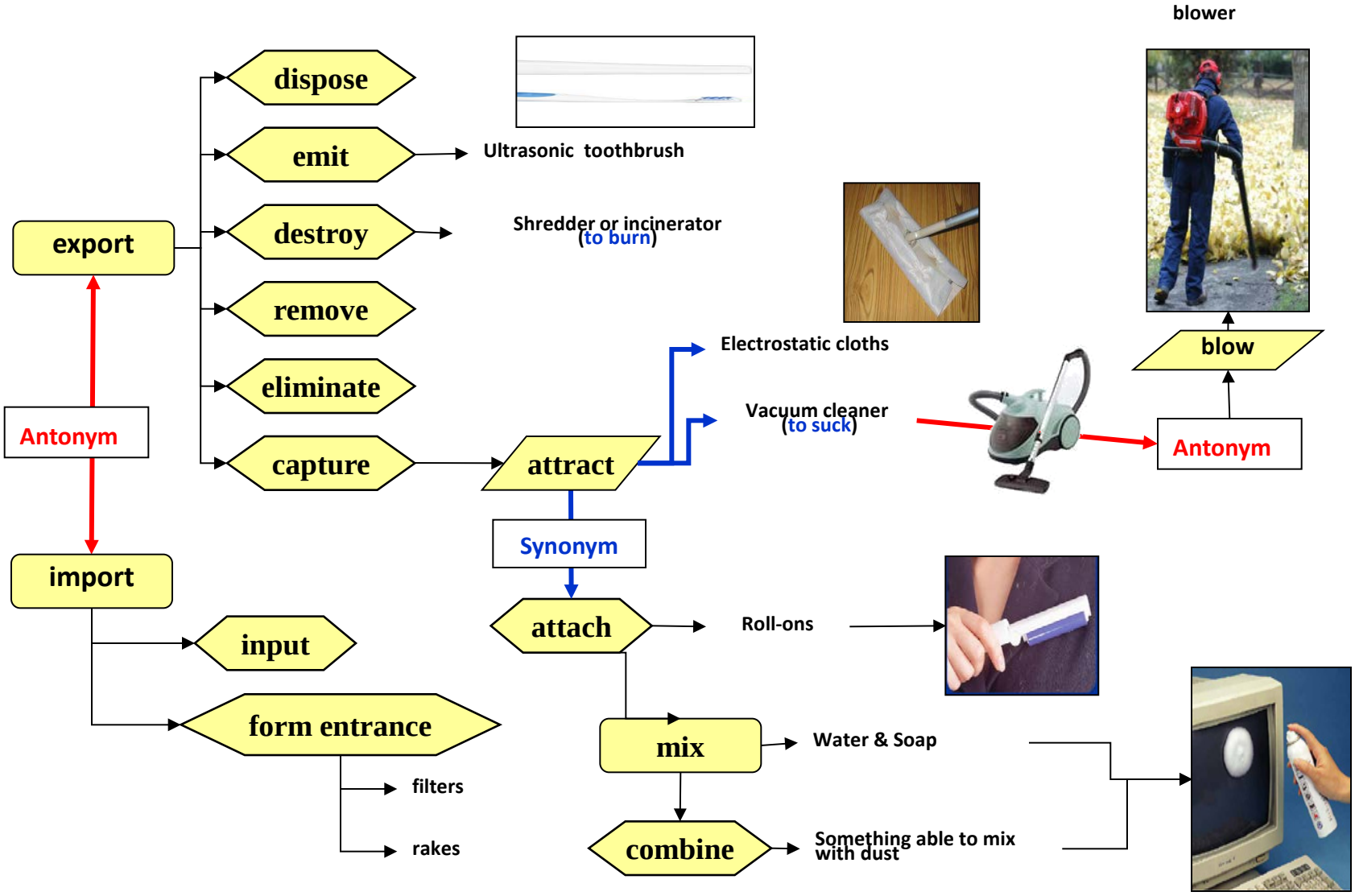
“EXPORT SOLID”

SINONIMI e CONTRARI

“PULIRE POLVERE/SPORCO”

Area	Class Functions - Equation(s) -	Base Functions - Parameters of the equations -	Detailed Functions - Declination of the parameter(s) -
Kinematics	Move	Move on closed path	Rotate, Spin, Turn, Flip1
		Move on open path	Advance, Lift1, Translate, Switch, Shift, Pick
		Vibrate	Oscillate1
Statics	Arrest	Arrest	Stop1
	Guide	Transfer	Transport, Deliver, Carry, Convey, Conduct1, Direct, Relocate, Steer
		Position	Locate1, Orient, Align, Place1, Flip2
	Obstacle	Obstacle	Constrain, Restrain1, Resist1, ***Deviate, Scatter, Brake***
	Block DOF	Block DOF	Lock, Hold1, Place2, ***Fasten, Fix1, Secure***
		Capture (=Block DOF+Join)	Inglobate, Contain1, Enclose, Grasp
	Allow DOF	Allow DOF	Open, Unfasten, Unlock, Permit
		Release (=Allow+Separate)	Disclose
	Support	Steady	Hold2, ***Secure, Fasten, Fix1***
		Reinforce	Back, Brace, Line
Dynamics	Interact	Interact	Touch1, Hit, Hammer, ***Bounce***
		Attract	Pull, Lift2
		Repulse	Push, ***Bounce, Deviate, Scatter***
Exchange with External Environment	Import	Import	Insul, Absorb1, ***Fill***
		Supply	Provide, Retrieve
	Export	Transmit (useful)	Eject, Emit1, Output, Diffuse2, Conduct2, Transfer2
		Discard (useless) (=E.+Remove)	Dispose, Eliminate, Reject
	Store	Store	Accumulate, Reserve, Contain2, Shelf, Register, Record
		Collect	Replenish, Refill
	Add	Add	Addition, Absorb1, Dope, ***Fill, Insulate***
		Create	Generate
	Subtract	Subtract	Empty, Absorb2
		Destroy	Delete, Annihilate
	Detect	Detect (spot)	Sense3, Find1, Determine, Perceive, Locate2, Measure1
		Monitor (repeatedly)	Track, Time, Control1, Sense2, Measure2, Feel2
	Display	Indicate	Show, Announce, Expose, Emit2
		Label	Denote, Mark
Connection : Logical	Relate	Order	Sort, Classify
		Compare	Confront, Discern, Recognize, ***Identify***
		Associate	Link1, Correlate, Couple1
Connection: Union	Select	Select	Choose, ***Identify***
	Join	Join	Link2, Attach
		Blend (indistinguishable)	Mingle
		Mix (distinguishable)	Combine, Coalesce
	Assemble	Assemble	Connect1, Mount
		Bring close	Mate, Attract, Touch2, Couple2
Connection:	Branch	Separate	Sever, Dissoin, Split , Cut1, Divide1
		Extract	Refine, Filter, Percolate, Strain, Clear1, ***Purify***
		Remove	Cut2, Lathe, Sand, Abrade, Ablation, Drill, ***Polish***
		Distribute	Diffuse1, Dispel, Disperse, Scatter, ***Diverge***
	Disassemble	Disassemble	Disconnect1, Unmount
		Move apart	Divide2, Isolate, Detach, Repel, ***Diverge***
Qualitative Transformation	Transform	Shape	Form, Deform, Adapt1, Compact, Compress, Pierce, ***Crush***
		Convert	Condense, Evaporate, Liquefy, Solidify, Temper, Quench
		Elaborate Data	Encode, Decode, Differentiate, Integrate, Digitize, Calculate
		Process	Prepare1, Clear1, Treat, Condition, Distillate
	Improve	Improve	Clear2, ***Purify, Polish***
		Protect	Shield, Prevent, ***Insulate***
	Degrade	Deteriorate	***Crush***
		Dissipate	Consume, ***Brake***
	Stay	Stay	Maintain
Quantitative Transformation	Vary	Increase	Amplify, Enhance, Magnify, Multiply
		Decrease	Attenuate, Dampen, Reduce
		Change	Scale, Modify (value)
		Alternate	Oscillate2
	Stabilize	Stabilize	Fix2
	Set	Regulate	Equalize, Limit1, Control2, Invert, Adjust, Modulate, Adapt2
	Unset	Unset	Demodulate, Reset, Clear3
Functioning	Initiate	Initiate	Start, Turn on, Switch on
		Enable	Prepare2, Open, Connect2, Allow
	Operate	Operate	Run, Work, Actuate
	Terminate	Terminate	Turn off, End, Halt, Stop2, Pause, Interrupt, Switch off
		Disable	Close, Disconnect2
	Inhibit	Inhibit	Delay, Restrain2, Resist2, Limit2

Ricerca di varianti funzionali



Ricerca di varianti funzionali

Broom 	Shredder 	Incinerator 	Adhesive rollon 	Electrostatic cloth 
Reactive foam/ reactive spray 	Vacuum cleaner 	Blower 	Washing machine 	Ultrasonic toothbrush 
High pressure washer 	Vapor cleaner 	Sand blaster 	CO_2 sand blaster 	…

Device description in Functional Terms:

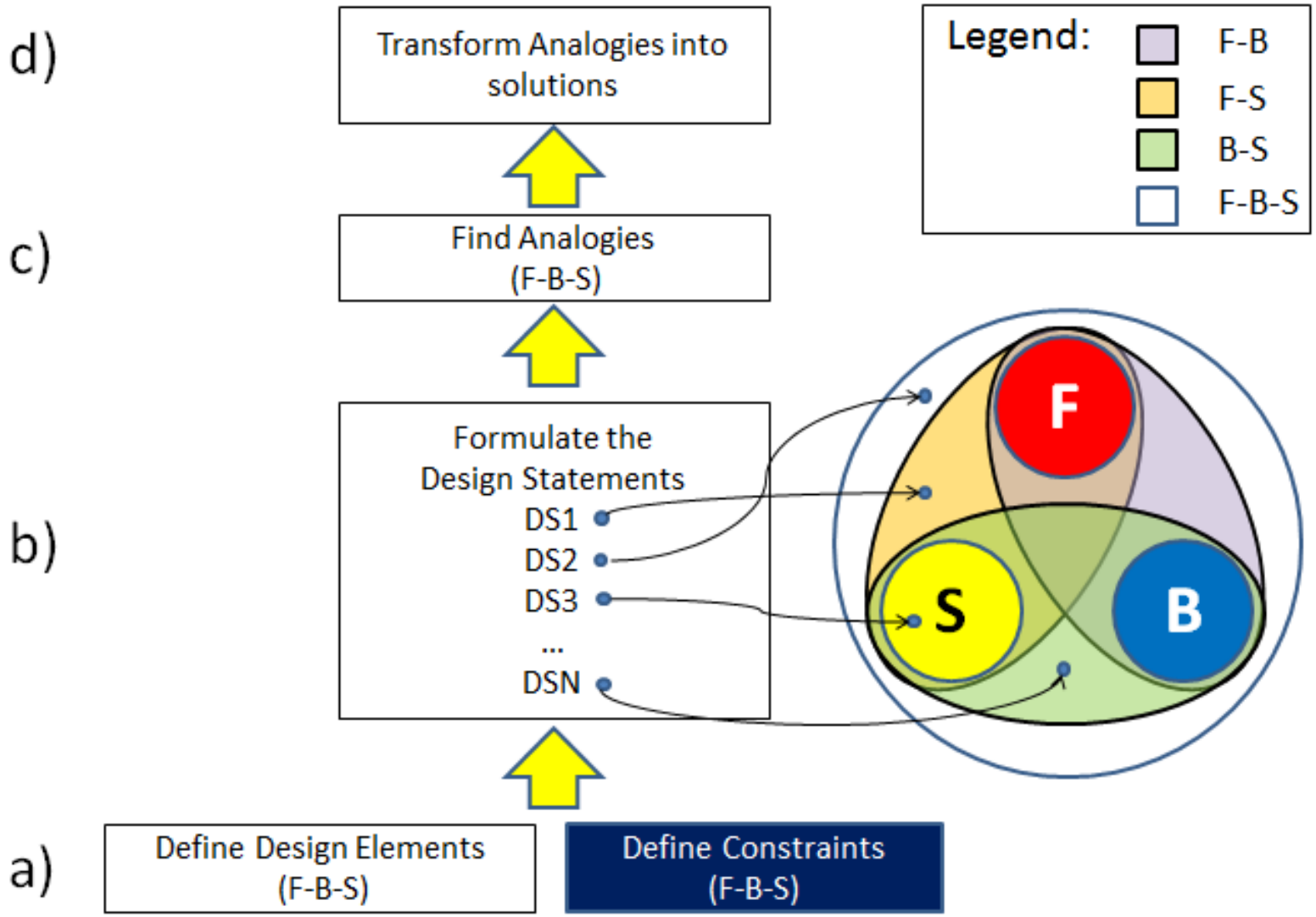
FR0: cut the sclera;

FR1: position probe tip;

FR2: remove vitreous;

FR3: cut vitreous.

Analogical Reasoning in FBS space



Analogical Reasoning

- Formulation based on **S**tructure. “Please list examples of devices[1] where there is an outer tube with a port at the end and a moving guillotine that moves up and down opening and closing the port”.
- Formulation based on **F**unctions (in particular FR2). “Please list examples of devices where a material (solid, liquid or gas) is sucked”.
- Formulation based on **F**unctions (in particular FR3). “Please list devices to cut filamentary structures anchored to a surface (imagine hairs, grass, etc..)”.
- Formulation based on **S**tructure and **F**unctions (in particular FR3). “Please list examples of devices where a tube/pipe is used to break and remove materials in form of solid or liquid”.
- Formulation based on **B**ehaviors. “Please list devices or procedures able to fluidity a material from solid or gel state to liquid state”.

[1] but also living beings or organs

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