Some basic concepts on creativity and innovation

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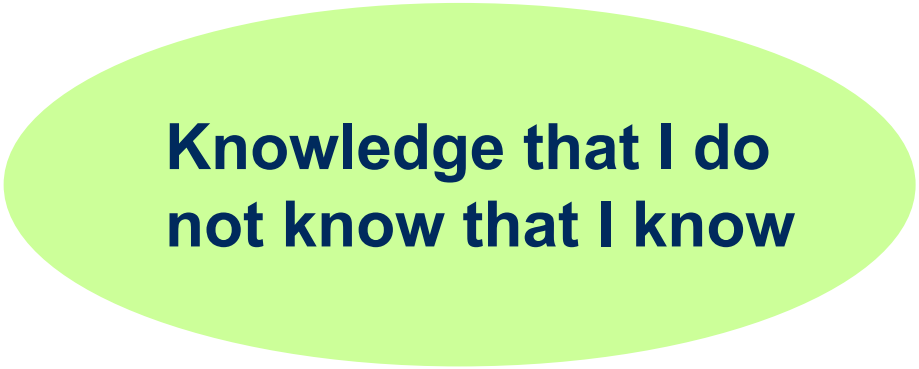
To be create it is important to know the

“Knowledge Sets”

The First Knowledge Set

The Second Knowledge Set



The Third Knowledge Set

I do not know that I know

This red background makes us remember anxiety, nervousness,... and we tend to put this set as the most important knowledge set, but it is not.

The Fourth Knowledge Set

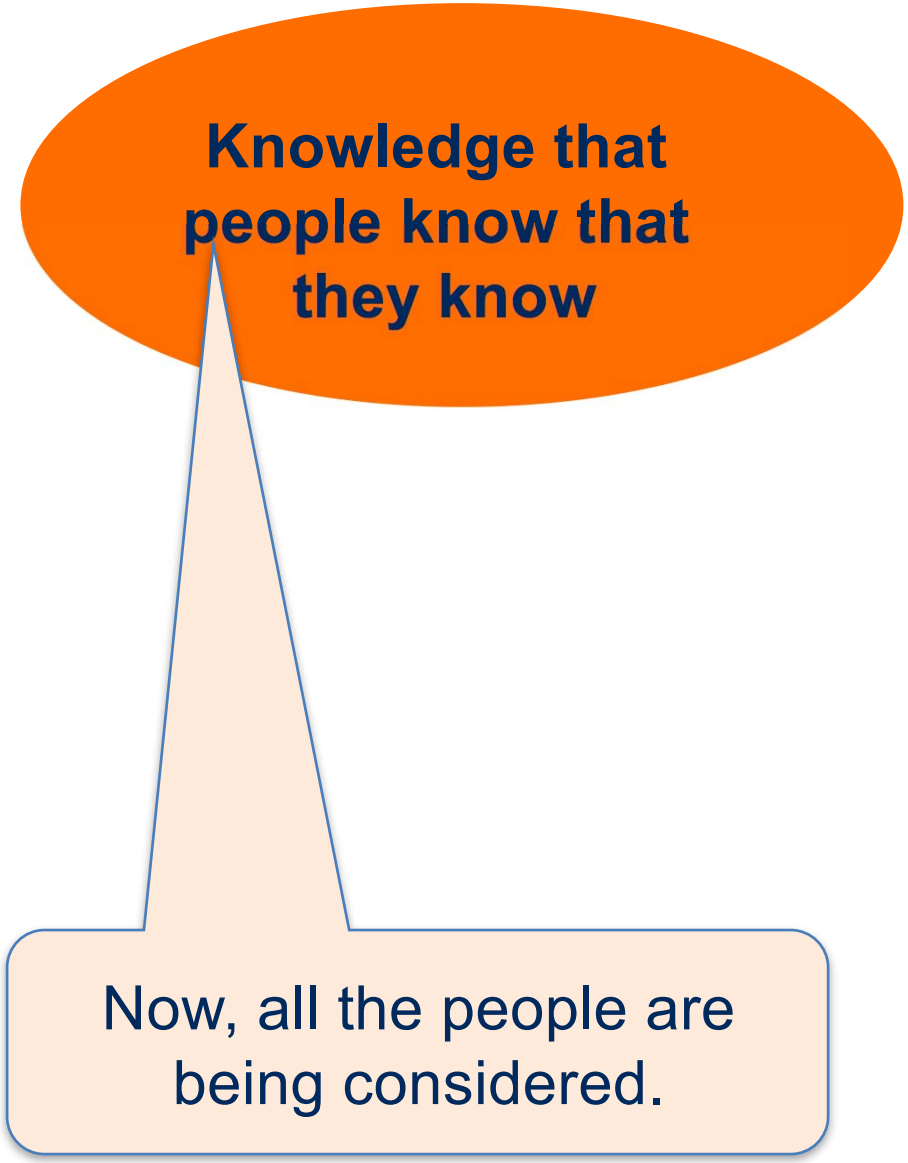
I don't know that I know

I don't know that I don't know

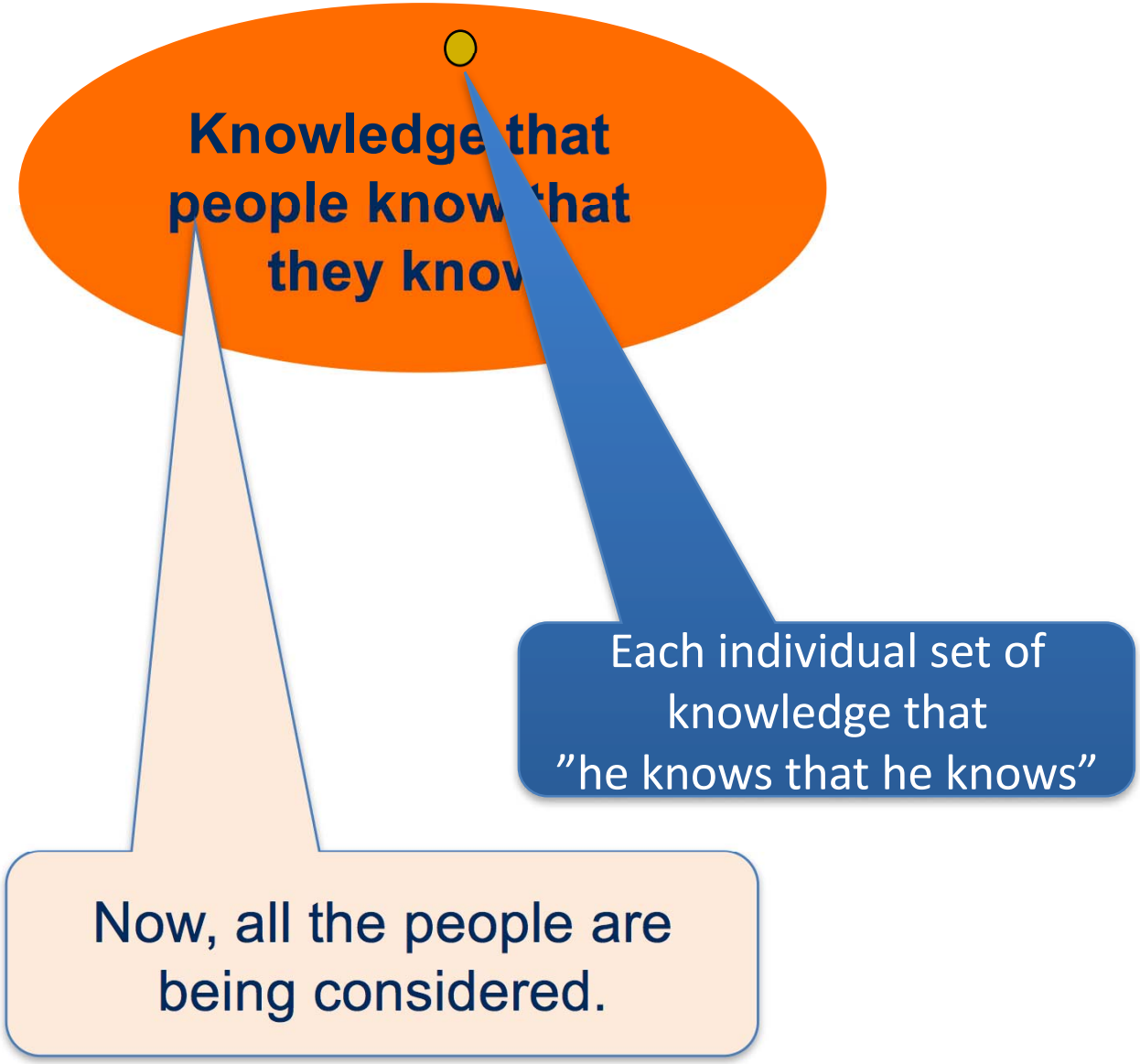
Question:

How the knowledge move between these sets?

Under Graduation Course



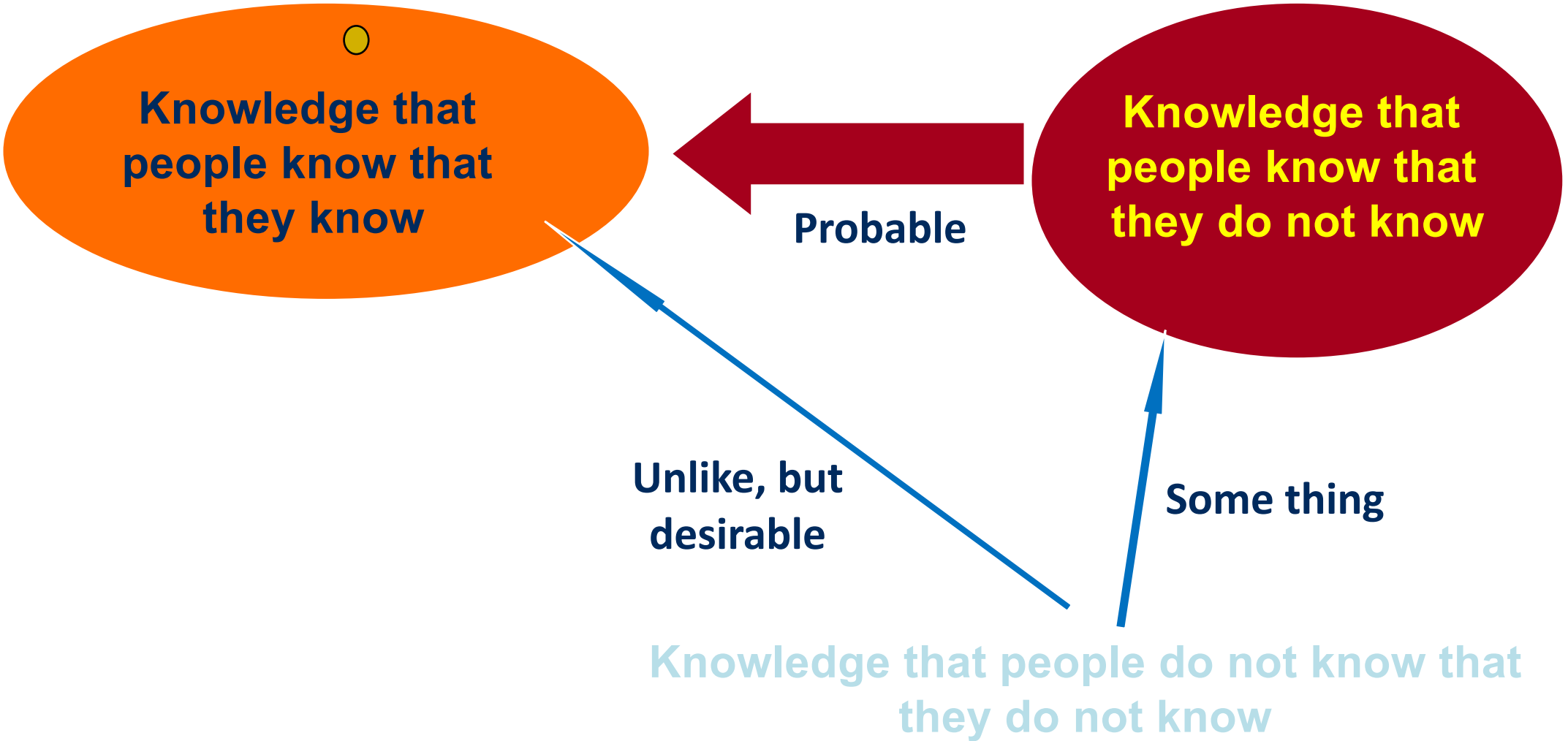
Under Graduation Course



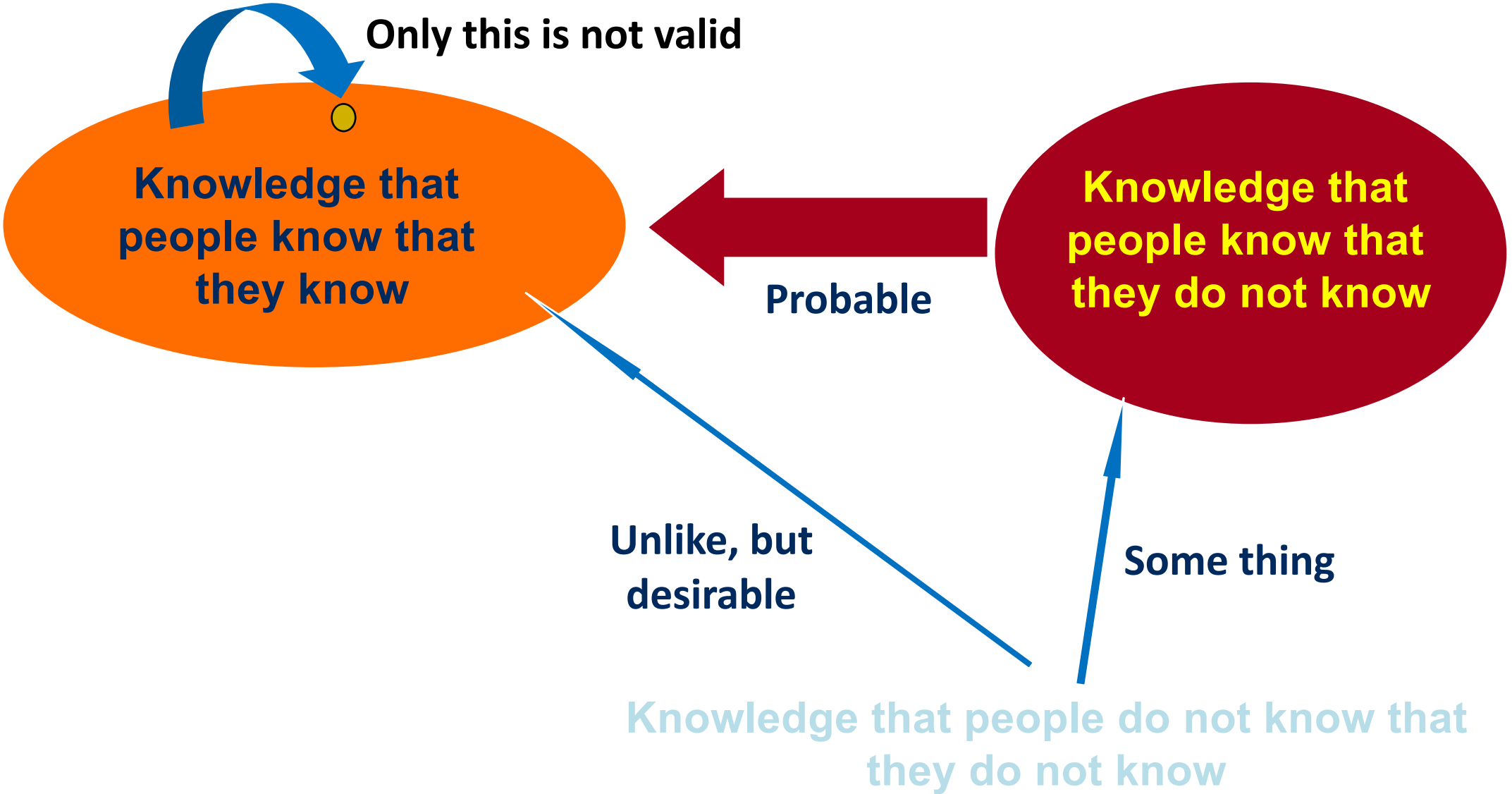
Under Graduation Course

- The objective is to teach the students some **already consolidated knowledge**: they can be found in **books, magazines, journals, internet, teacher's mind**, etc.

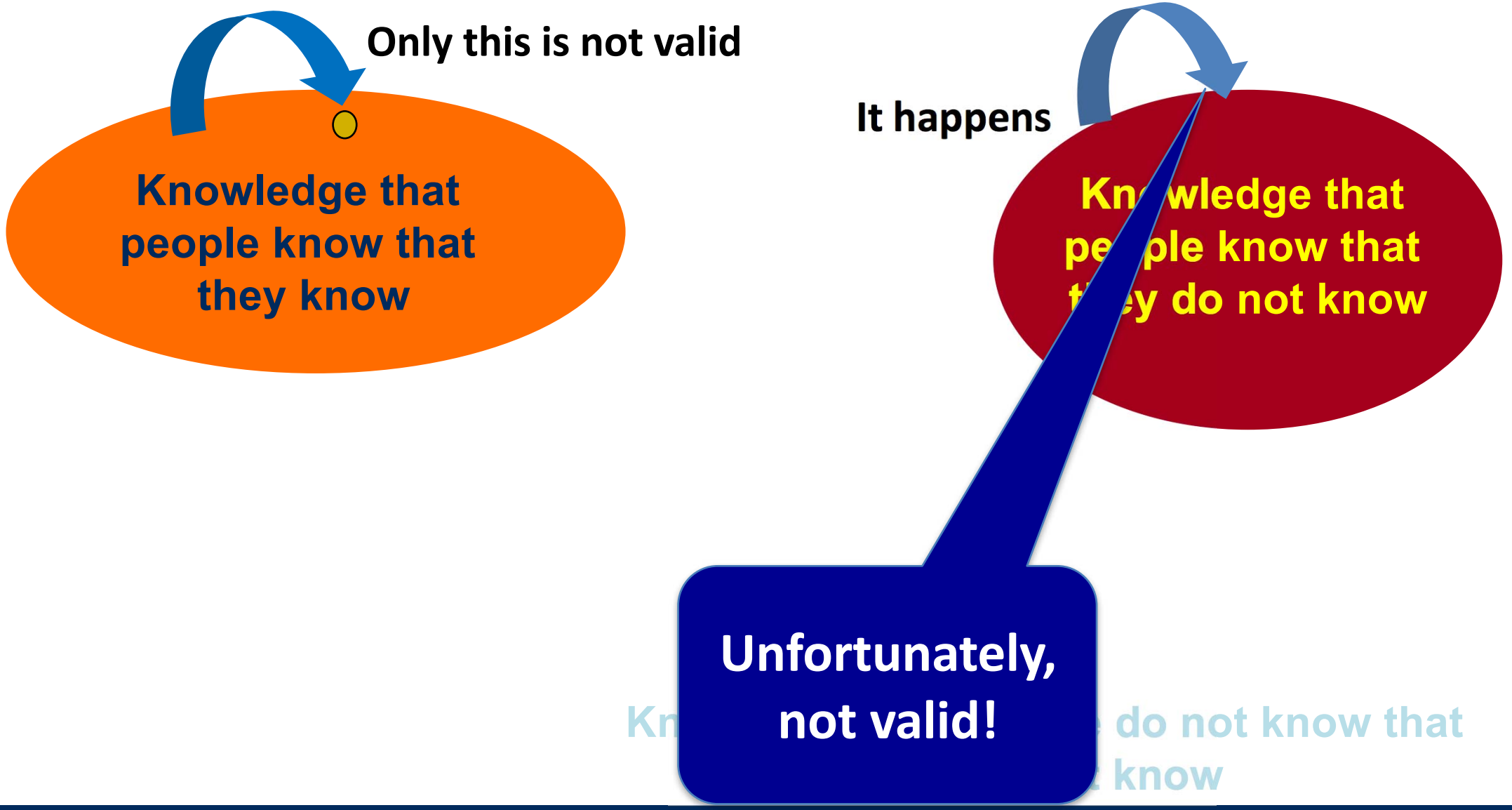
Master Course



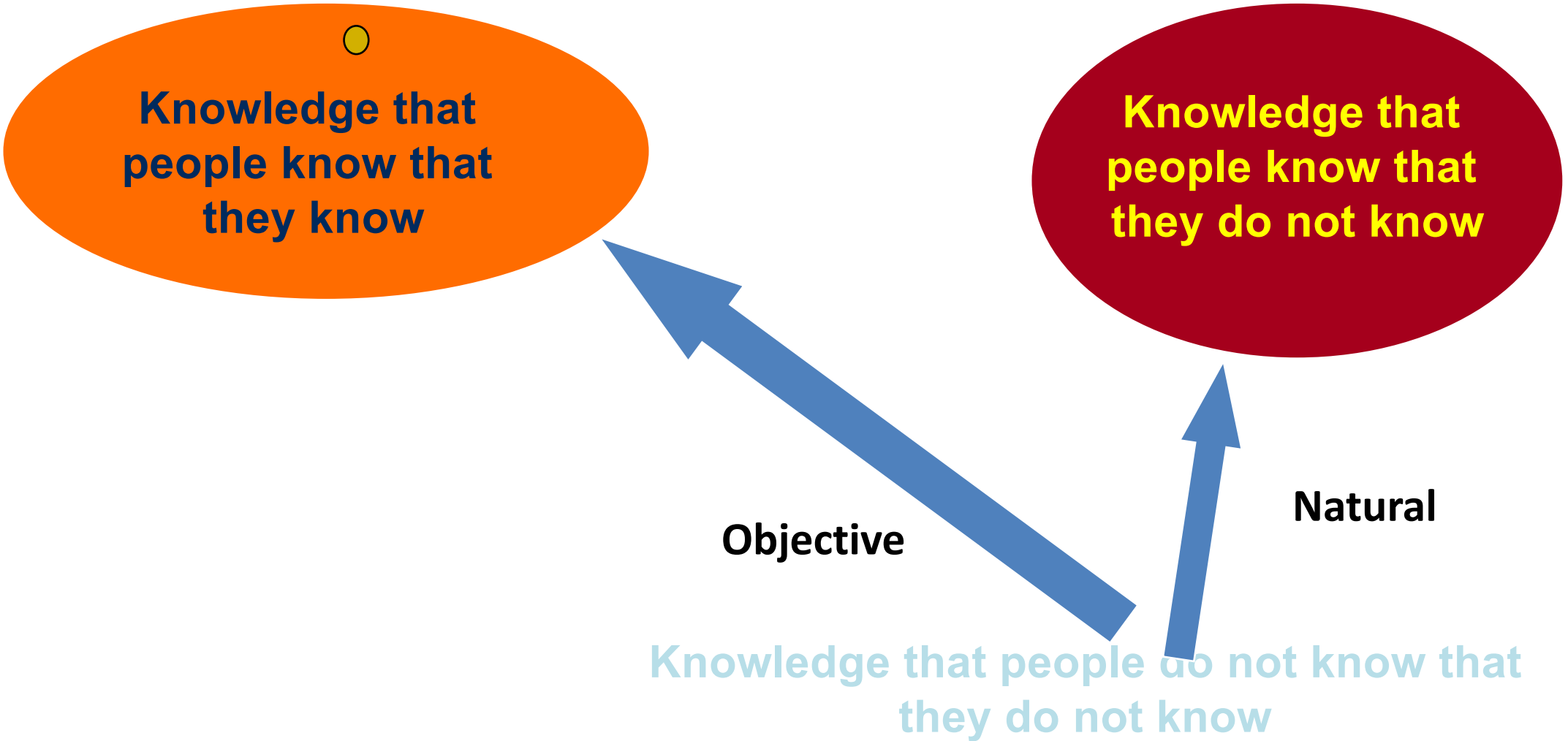
Master Course



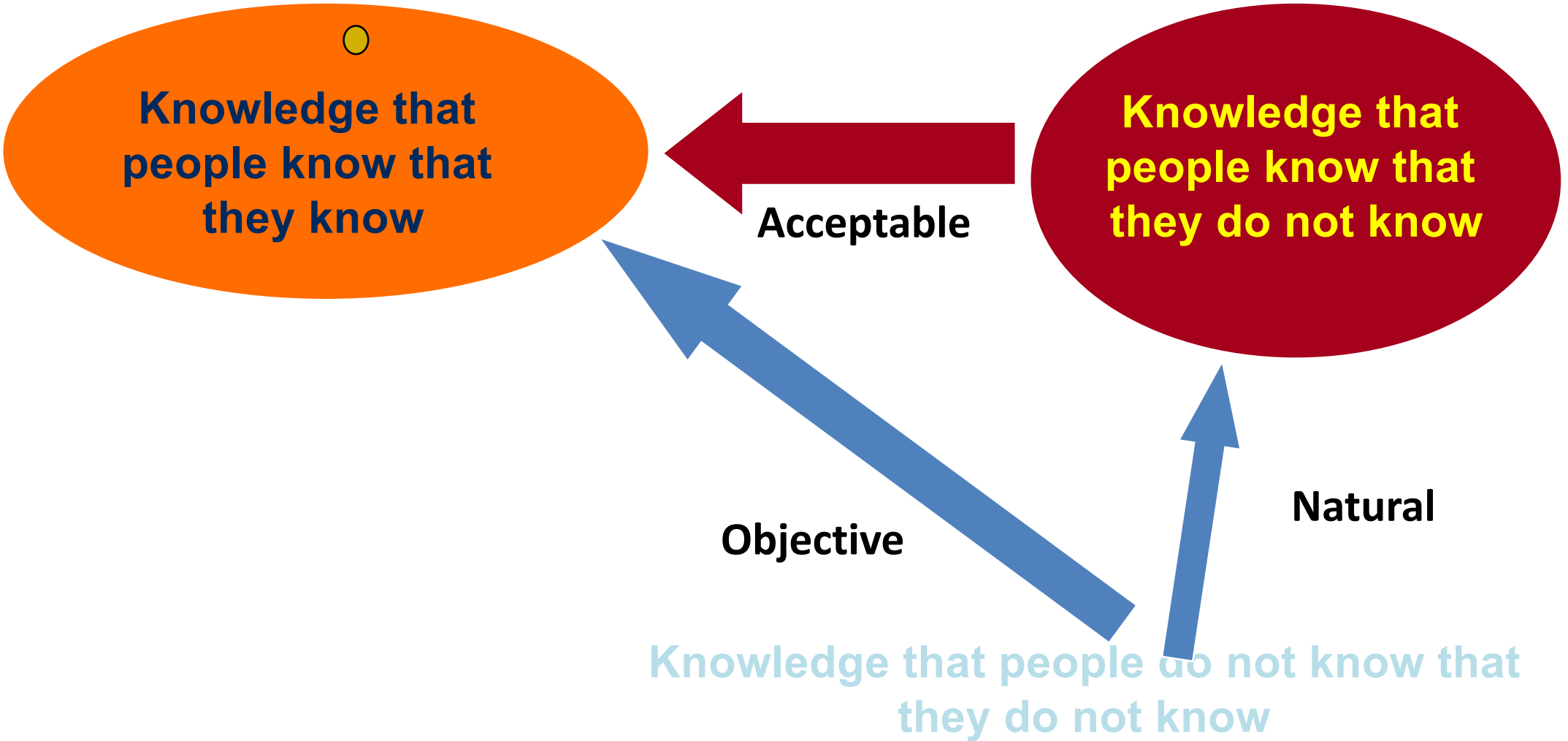
Master Course



Doctor Course



Doctor Course



Under Graduation and Graduated Courses

Under Graduation Courses:

- Teach **already consolidated knowledge**

Graduated Courses:

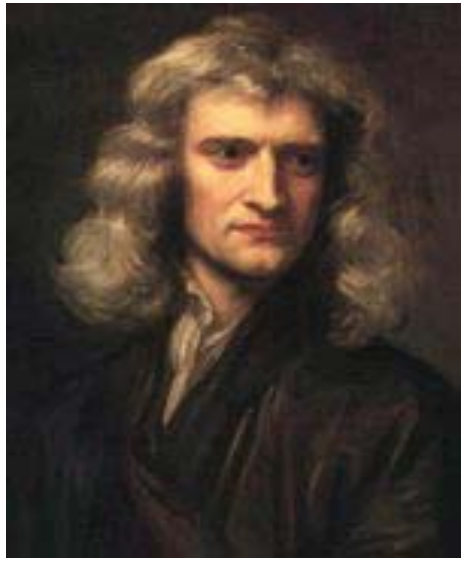
- Prepare the student to **discover problems**
- **Find solutions or explanations**
- Be **daring and creative**
- Be **undisciplined** (do not follow the discipline: be **interdisciplinary** or **multidisciplinary**)
- The doctor student should "**surprise the supervisor**"

Student curiosity:

Could you tell me what is in the set of knowledge that

“People do not know that they do not know”?

An classical problem example that we did not know we did not know:



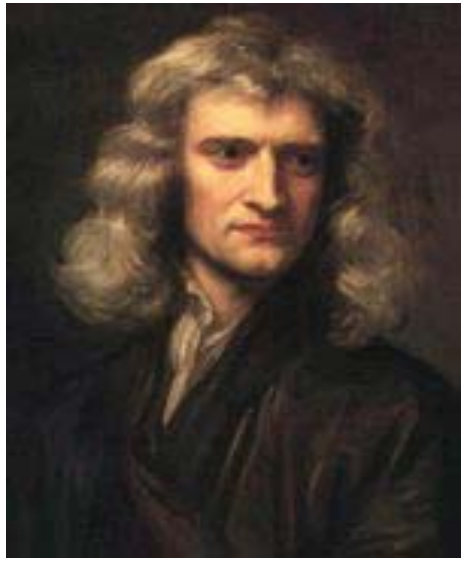
Isaac Newton

1643-1727

Imagine an apple falling on Newton.

Newton (version 2018)

An classical problem example that we did not know we did not know:



Isaac Newton

1643-1727

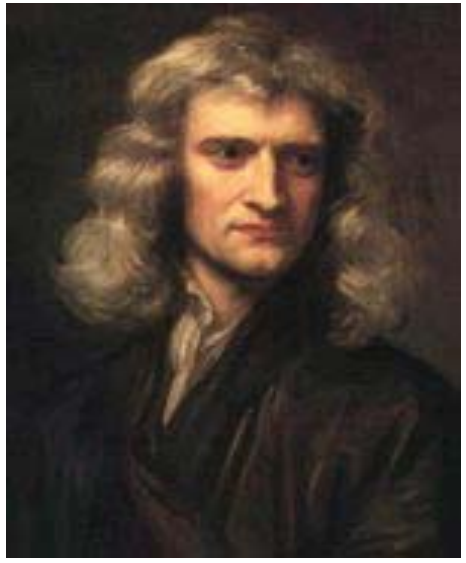
Newton (version 2018)

An falling apple...

Is this phenomenon a problem?

A problem that deserves to be solved?

An classical problem example that we did not know we did not know:



Isaac Newton

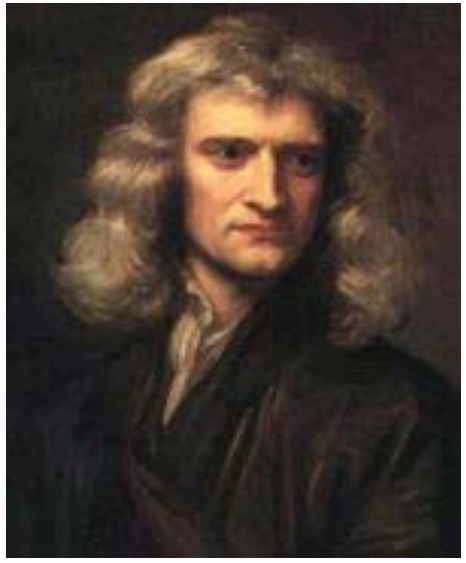
1643-1727

Newton (version 2018)

Is this phenomenon a problem?

How about if it were a jackfruit?

Um exemplo clássico de um problema que nem sabíamos que não sabíamos:



Isaac Newton

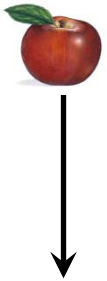
1643-1727

For the majority, this phenomenon is not a problem.

But, for Newton it was.

Newton (version 2014)

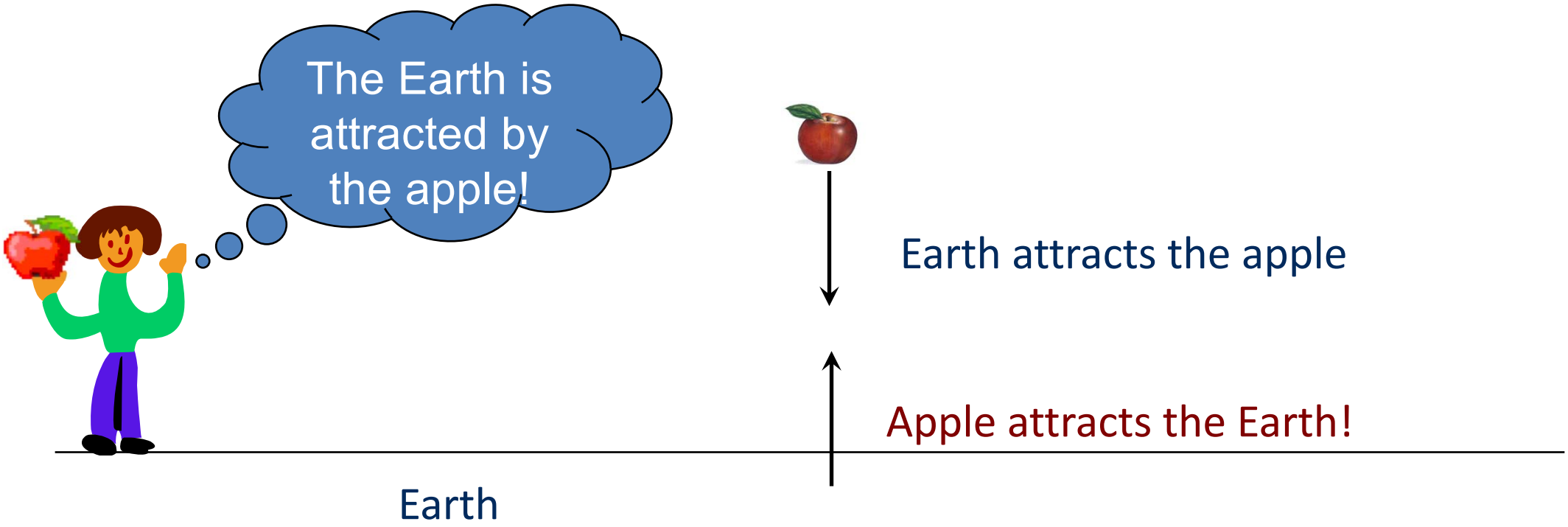
A Genius Vision 1



Earth attracts the apple

Earth

A Genius Vision 2



And, from this, Newton proposed the Law of the Universal Gravitation.
He started all this at the age of 21 years!

Good Ideas

If good ideas may come from **NOTHING**, why the financing agencies or investor do not invest money on people that are still with few publications or have a simple curriculum?

Good Ideas

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VALID LOGIC TODAY:

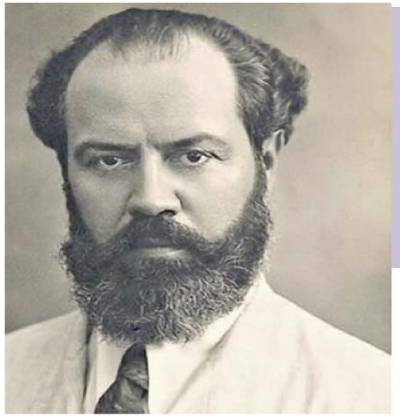
“DE ONDE MENOS SE ESPERA É QUE NÃO SAI NADA MESMO.”

“From where we do not expect anything is from where nothing will come out”

Good Ideas

If good ideas may come from **NOTHING**, why the financing agencies or investor do not invest money on people that are still with few publications or have a simple curriculum?

VALID LOGIC TODAY:

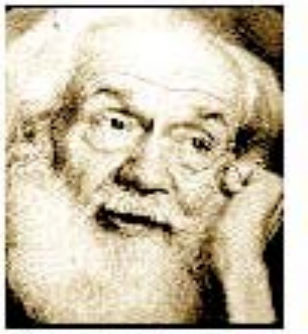


1895 - 1971

"DE ONDE MENOS SE ESPERA É QUE NÃO SAI NADA MESMO."

Apparício Fernando de Brinkerhoff Torelly, who self proclaimed **Duke of Itararé**, in October 1930.

Baron of Itararé



Soon after he self proclaimed **Duke of Itararé**, he self degraded his title to **Baron of Itararé.**
(As a proof of modesty.)

It is important **to know the size of your ego** and **improve your curriculum**.

Conclusion

- There are things that we do not know that we do not know;
- You should doubt everything (Including professor);
- You should look for problems and solutions;
- You should be convincing;
- You should publish what you discover or discover what can be published to improve your curriculum.

- These points should be good for a good professional life!

Curiosity

- **Dunning–Kruger effect:**

"**High ability** people mistakenly assess their ability as smaller than it is or **high ability people tend to be unconfident when facing a new problem**."

"**Low ability** people mistakenly assess their ability as higher than it is or **low ability people tend to be confident when facing an old problem." (And ignore new problems).**

Curiosity

- **Scientific American (blog published 15 August 2018):**

"Unknown Unknowns: The Problem of Hypocognition"

- "**Hypocognition** means the lack of a linguistic or cognitive representation for an object, category, or idea."
- "**It is difficult to see the culture we inhabit from only within**."

https://blogs.scientificamerican.com/observations/unknown-unknowns-the-problem-of-hypocognition/?utm_source=newsletter&utm_medium=email&utm_campaign=weekly-review&utm_content=link&utm_term=2018-08-15_featured-this-week

INNOVATION

One of our objective should be to transform science in product, if possible, an innovation.

So, what is innovation?

Science and Innovation

Innovation:

- It is not a good idea, a concept,…
- It is not a paper, a thesis,…
- Even a patent is not an innovation.

However, **innovation can be any of these things if it works and is approved by the market**. (Generally, it needs lot of sweat added).

Science and Innovation

Science transforms money in knowledge.

Innovation transforms knowledge in money.

Mario Borges, CNPq President

Innovator / Entrepreneur

An innovator / entrepreneur has to learn:
how to make things happen.

Requirement:

- **Courage**
- **Daring**
- **Flexible…**

Akio Morita (1926 – 1999)

He was an innovator (1950 - 1990)

- **Radio on battery that would fit in the pocket of the shirt (1957)**

- Transistor **TV** (‘60)
- Betamax System for video (‘80)
- **Walkman** (‘80)
- **Discman** (’90)

*The value of thesis, papers, patents better appear if they are transformed in **innovation**.*

Are we doing it correctly?

It is worth to remember the TRL concept or Technology Readiness Level.

(Invention by NASA)

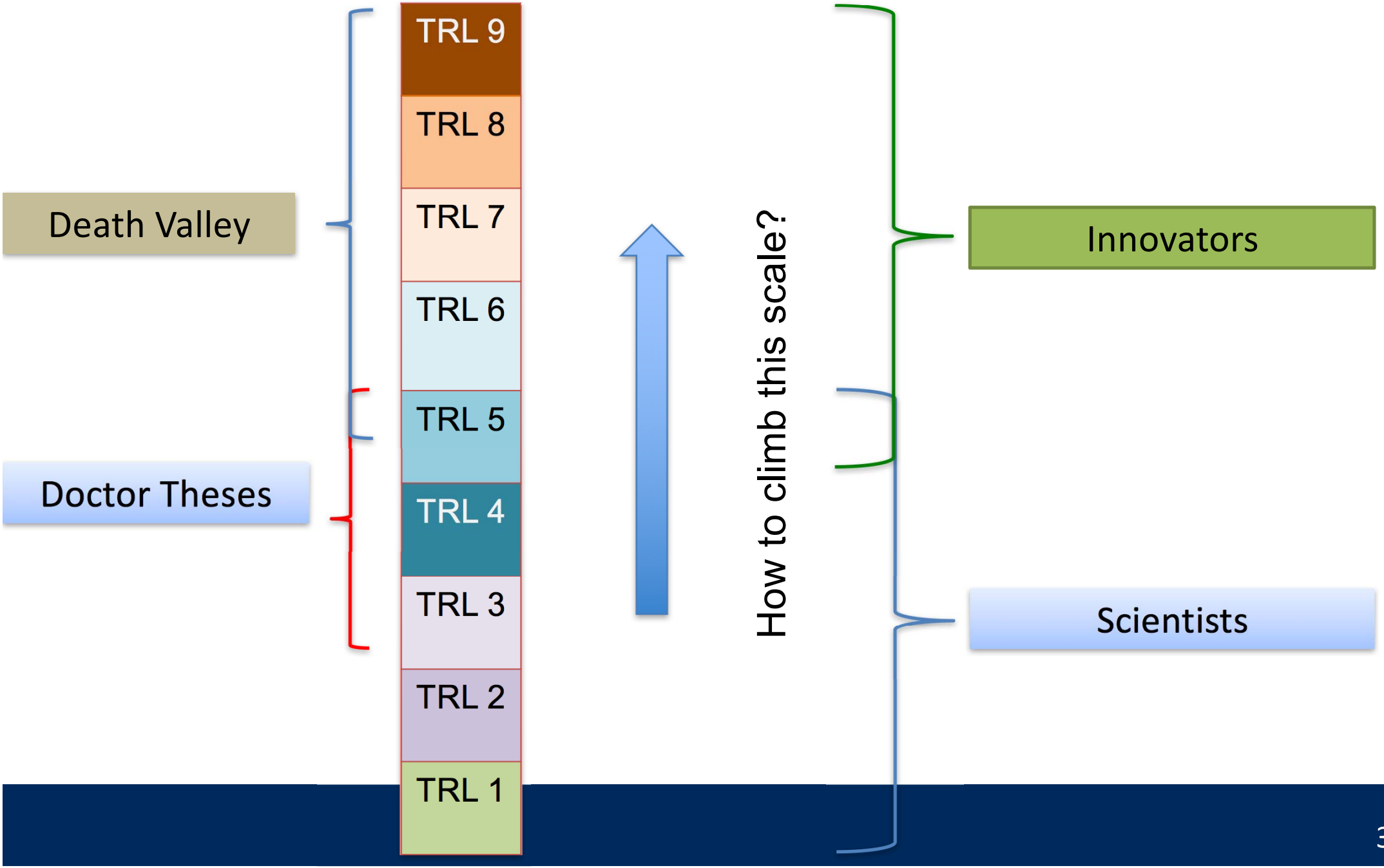
TRL Scale

Death Valley

Doctor Theses, paper, patent…

TRL 9	"Flight proven" actual system in successful mission
TRL 8	Actual system tested and "flight qualified" through tests and demonstrations
TRL 7	Prototype demonstration in actual environment
TRL 6	System or subsystem or prototype demonstration in relevant environment
TRL 5	Prototype or component validation in relevant environment
TRL 4	Prototype or component validation in laboratorial environment
TRL 3	Analytical and experimental proof of the concepts
TRL 2	Technological concepts or application formulated
TRL 1	Basic principle observed and reported

TRL and Innovation



What a difference S,T&I makes?

Product	US$ / ton
Iron ore	*70*
Soy bean (Johana Dobereiner)	*350*
Coffee (natural)	*2.000*
Coffee (in capsules)	*200.000*
iPhone	*5.000.000 (1 iPhone = US$700)*
Embraer 190 E2 (This one we export)	*2.000.000 (1 plane: US$60.000.000)*

Low S,T&I content!

With S,T&I

Inspired in a speech by Prof. Weber Figueiredo, CEFET

Let us put some attention on innovation?

Be alert to the set of knowledges that
we even know that we do not know.

Do not copy and paste!

Remember:

"**Knowledge has no limit**" (Workshop de PG de Botucatu)

Be an innovator!

Good luck!

Thank you!

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