

“Beyond” the PhD thesis

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VIEW OF PhD



Process



Outcome



Skills



Mindset

| PhD



Develops a Mindset



(on the way)
Requires / grows skills



(as result)
Pleasant Outcomes



(on the way)
There is a process

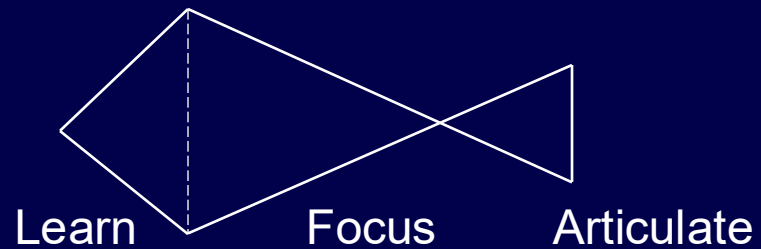
Attributes of PhD

I ... (good PhD)

I ... (excellent PhD)

I ... (secret ingredient)

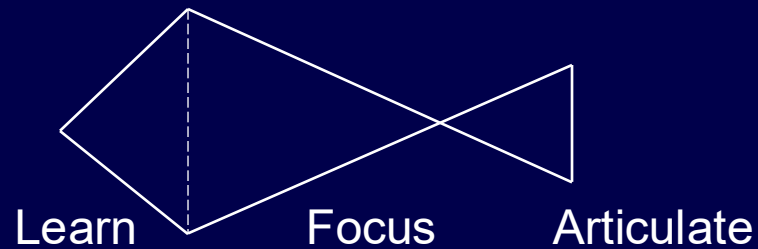
Things cannot change in 1 day



Fish model of PhD

Commensurate with a
process oriented view.

OBVIOUS SKILLS

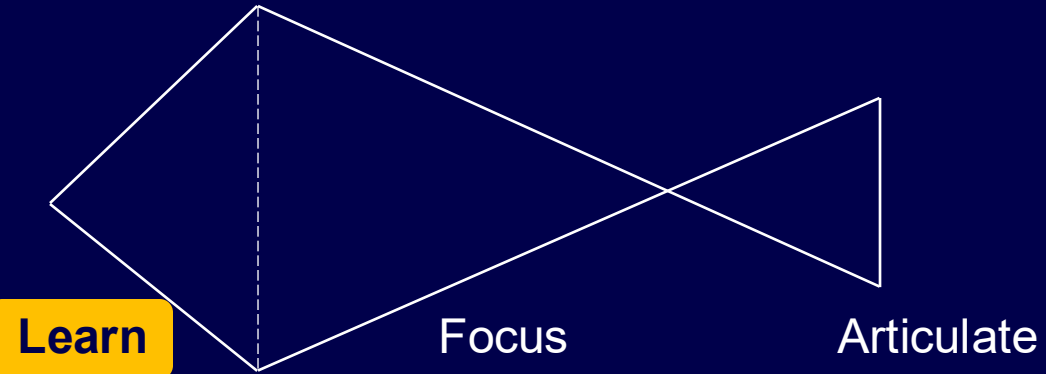


Fish model of PhD

- Reading a paper (state-of-the-art) and quickly judging a **contribution**
- Compare the contributions of each paper
 - Chart the growth of a research area
 - Identify emerging research trends
- Involves pro-actively looking **outside**, and doing so analytically

FIRST ATTRIBUTE

Initiative & Interest



LESS OBVIOUS SKILLS

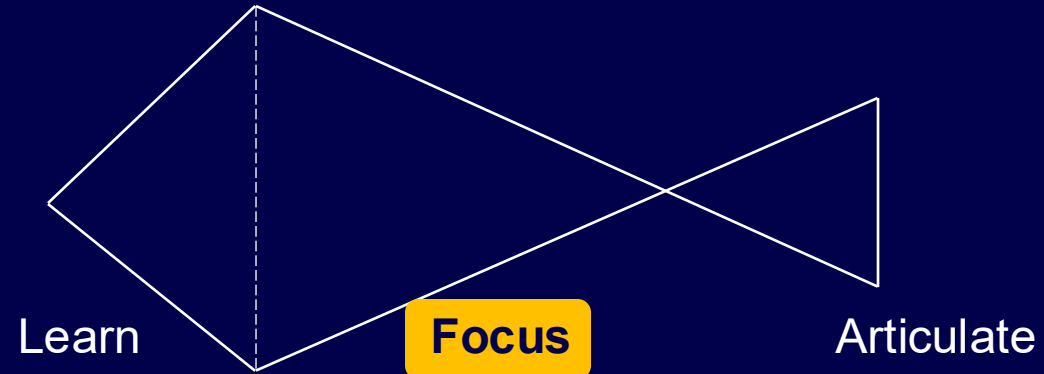


- Choosing the right problems at the **right time**
 - Choosing from a **known set** of problems
 - Why will it be impactful if you study it now?
 - What technical skills and background are needed, AND
- *Why you are the right person right now to tackle this problem?*
- Looking **inside** yourself: **reflection**

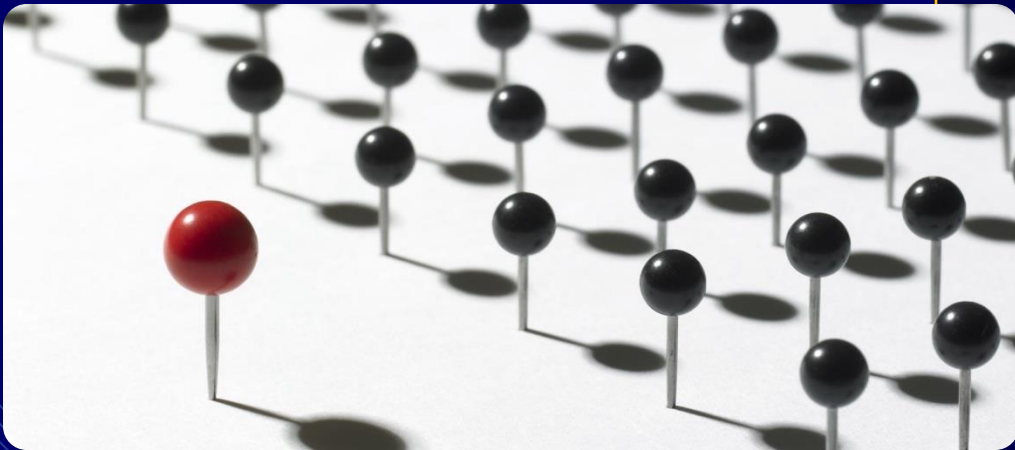
SECOND ATTRIBUTE

Introspection & Intuition

*Looking **inside***

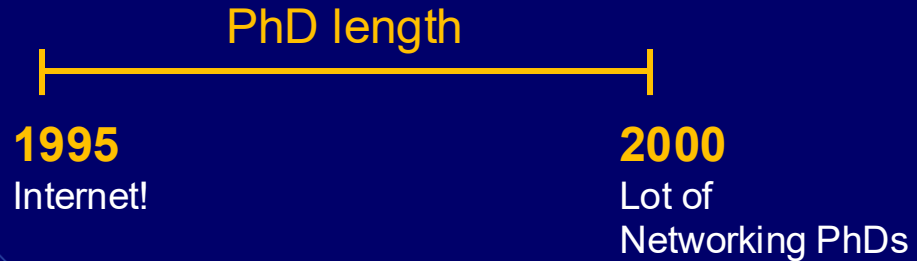


LEAST OBVIOUS SKILLS



- Develop clarity about research **contribution**
 - Research paper, degree, x number of citations??
- Contribution is how we progress the field
 - It is **Qualitative** in nature, as opposed to quantitative
 - Making space for others to contribute
 - Beyond high quality problem solving

GO BEYOND “HOT” TOPICS



A “hot” topic in 2025 may not be so in 2030.

“

If you see a bandwagon, it's too late. ”

Go beyond **hot** areas

- Go beyond technical contributions
- Conceptual contributions chart directions
- **Help create hot areas from cool ones**, using??

CONTRIBUTIONS & ATTRIBUTES

Contributions

“Utilitarian” Contribution

Technical Contribution

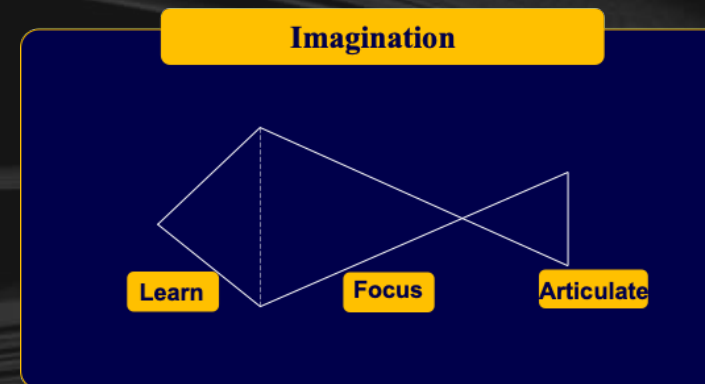
Conceptual Contribution

Attributes

Initiative & Interest

Introspection & Intuition

Imagination



MENTORING: ENCOURAGING SUCH ATTRIBUTES



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Papers < *Placement* < *Discussions*

Output < *Outcome* < *Experience*

Supervision << Advising

But, how to achieve it?

1. RECRUITMENT



Usual strategy: **contact your friends and see if they will recommend students!**

- **Did not conduct targeted recruit**
- Let the students come
- Led to a slow start
- Over time, led to a very **diverse research team** with diverse ideas

2. DISCUSSION BLAST FROM PAST ~10 YR AGO

- Motivation of research "area" ← who will fund this research and why?
- Future outlook. How does this go with technology growth in CS?
- Related to above point, let us think about timeline ~ when and how do you see it being deployed.
 - [5 years] - [50 years].
- Intellectual curiosity behind the problem. Can you explain it to an intelligent outsider.
 - ↳ [the point about imagination]
- What is the fresh outlook you bring to the problem.
 - ↳ [the point about conceptual contribution]
- What is the training you have from your advisor or undergraduate studies?
 - ↳ [the point about technical contribution, elaborate this in class].
- How impressive results can you bring in? - Availability of open source/homegrown tools in your group!
 - ↳ [Your own implementation/experiences / utilitarian contribution] OFTEN THE FOCUS of many students!!

3. CREATE COLLAB SPACE

Research Problem: Develop a lightweight security testing technique for software based on random search (fuzzing), which is almost as effective as systematic search using symbolic program analysis!

What is most effective: find more bugs **[Utilitarian]**

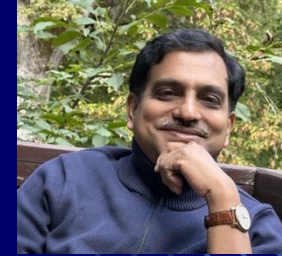
The fuzzing search is less sophisticated — how to make it more efficient and more effective? **[Technical]**

How can you achieve a fuzzing search which will look and feel like fuzzing but achieves symbolic execution? What is the smallest change in the fuzzing algorithm which will achieve this? **[Imaginative]**



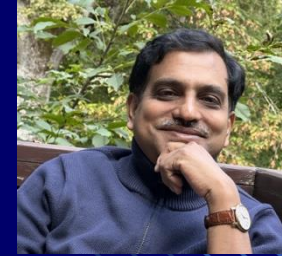
All the attributes are needed.
Give people time to accumulate them —
but use the diversity to bring them into a
single project at any point of time!!

LOOKING BACK 25 YEARS



- Joined NUS in Jan 2001 after my PhD. Mainly had **three observations** back in 2001
- *Achieve diversity in research teams*. Led to slow start, diversity was not in vogue then
 - **Encourage diversity of thought!**
 - My PhD thesis was very formal, but **I tried to recruit diverse set of students**
- *Beyond mastery of one technology*. Fashionable — MC (then), DL (now)!
 - Allowed the focus on **conceptual innovations** apart from technical ones
 - Focused on new usage scenario of the technologies, apart from scalability

LOOKING BACK 25 YEARS



- *Qualitative way of looking at research. **Avoid emphasis on quantitative**, and...*
 - Focus on a **thematic outlook of research** and not an output-oriented one
 - Try out diversity of ideas within a theme
 - **Both formal (my PhD) and informal (acquired with effort after PhD)...**

PLEASANT EXPERIENCES

What I did know in 2001:

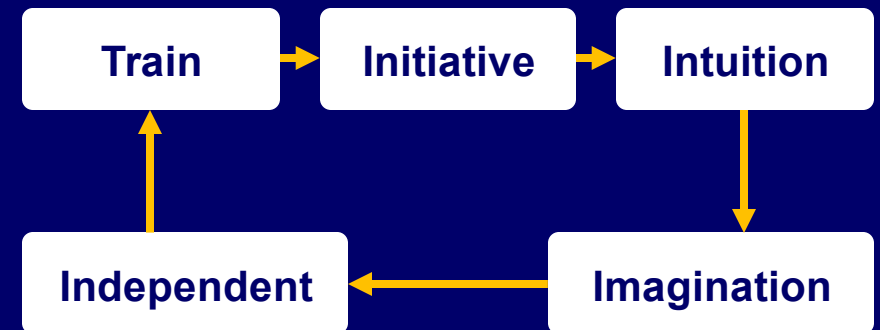
Took risks in my research journey,
encouraged students to take necessary & strategic risks

Why I focused on mentoring:

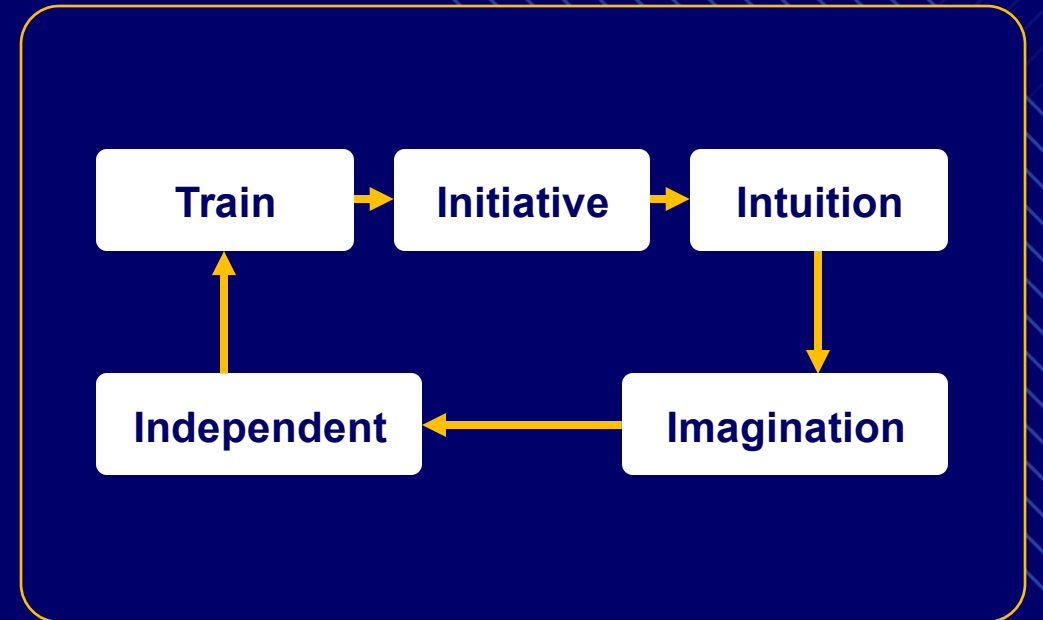
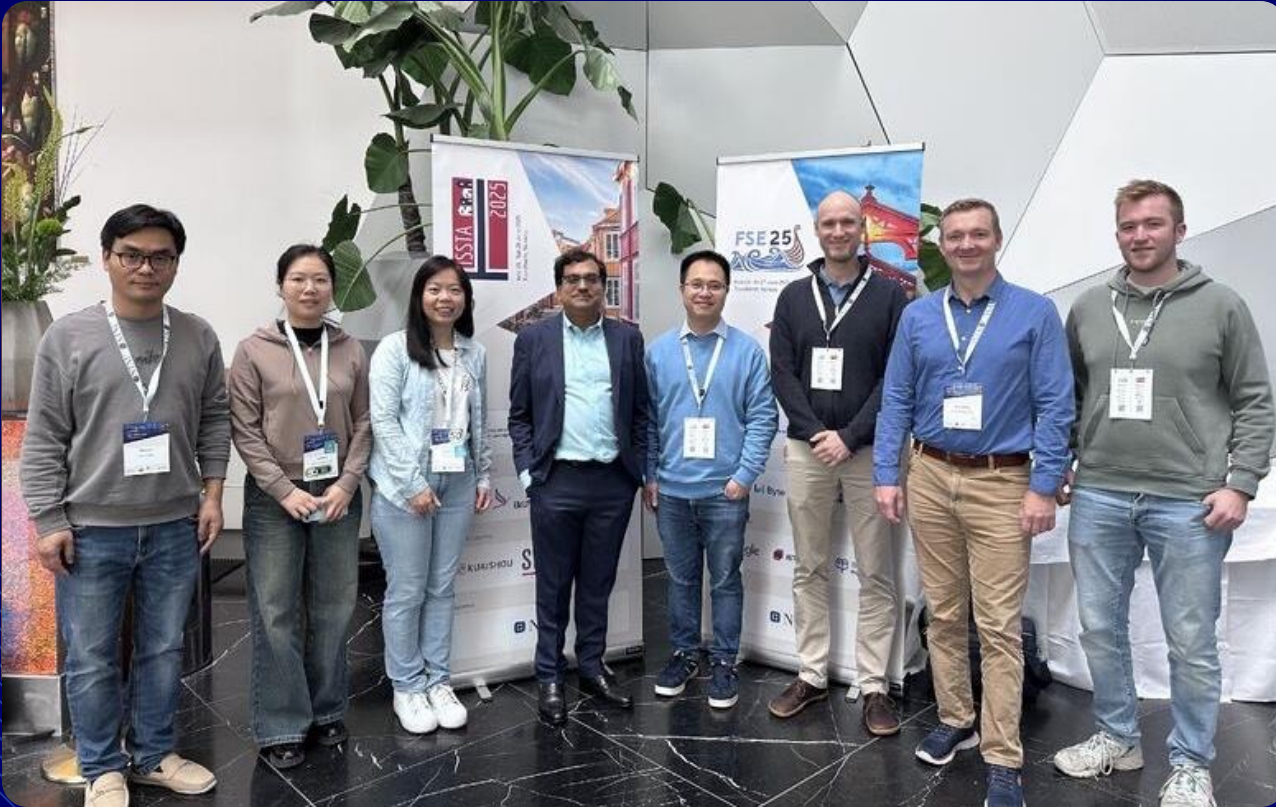
PASSION ! Mentoring was not fashionable in 2001, or even 2010
To be proud of what I leave – when I retire from academia !

What I did not know in 2001:

Spending time on mentoring did not reduce research,
“**Roy family**” 😊 enhanced my research via discussions and
even in terms of standing in research community.



PLEASANT EXPERIENCES



Past, present, future students DEDICATION

For all that I have learnt from them!!

“

He continues to teach because it provides him with a livelihood: also because it teaches him humility...

The irony does not escape him: that the one who comes to teach learns the keenest of lessons,

~~While those who come to learn learn nothing.~~

- J. M. Coetzee



| TAKEAWAY



Where one is coming from

<<



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Where one can go to