

Managing Goal Conflicts in a biomedical Research Laboratory

Viji Vijayan
Associate Professor
Duke-NUS Medical School
Singapore



Singapore



- **Established in 2005, first US-style graduate-entry medical school**
- **>300 graduated as doctors**
- **Strong PhD program**
- **48 patents granted, 18 licenses awarded, 14 spin offs**
- **4,500 peer-reviewed journal articles**
- **Co-located – Singapore's largest healthcare group – augments translational research**



- Wet bench labs
- Insectary
- Fly lab
- Animal Biosafety level 3 facilities
- Mouse and rat facilities
- Imaging
- Cell Sorting
- Mass Spectrometry



- Safety is managed by the Department of Safety Health and Emergency Management
- Five staff in the Department
- The Safety Department works very closely with the labs to make sure that regulations are followed at the same time productivity does not suffer
- The entire School is OHSAS 18001 certified annually for the past five years





DukeNUS
Medical School

Together we strive....



Transforming Medicine, Improving Lives.

Safety Science is an international medium for research in the science and technology of human safety

It can be related to work, home, leisure

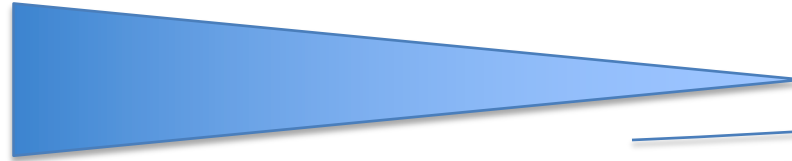
Safety Science is multidisciplinary





**Low risk high
power**

**High risk low
power**



Blunt end workers

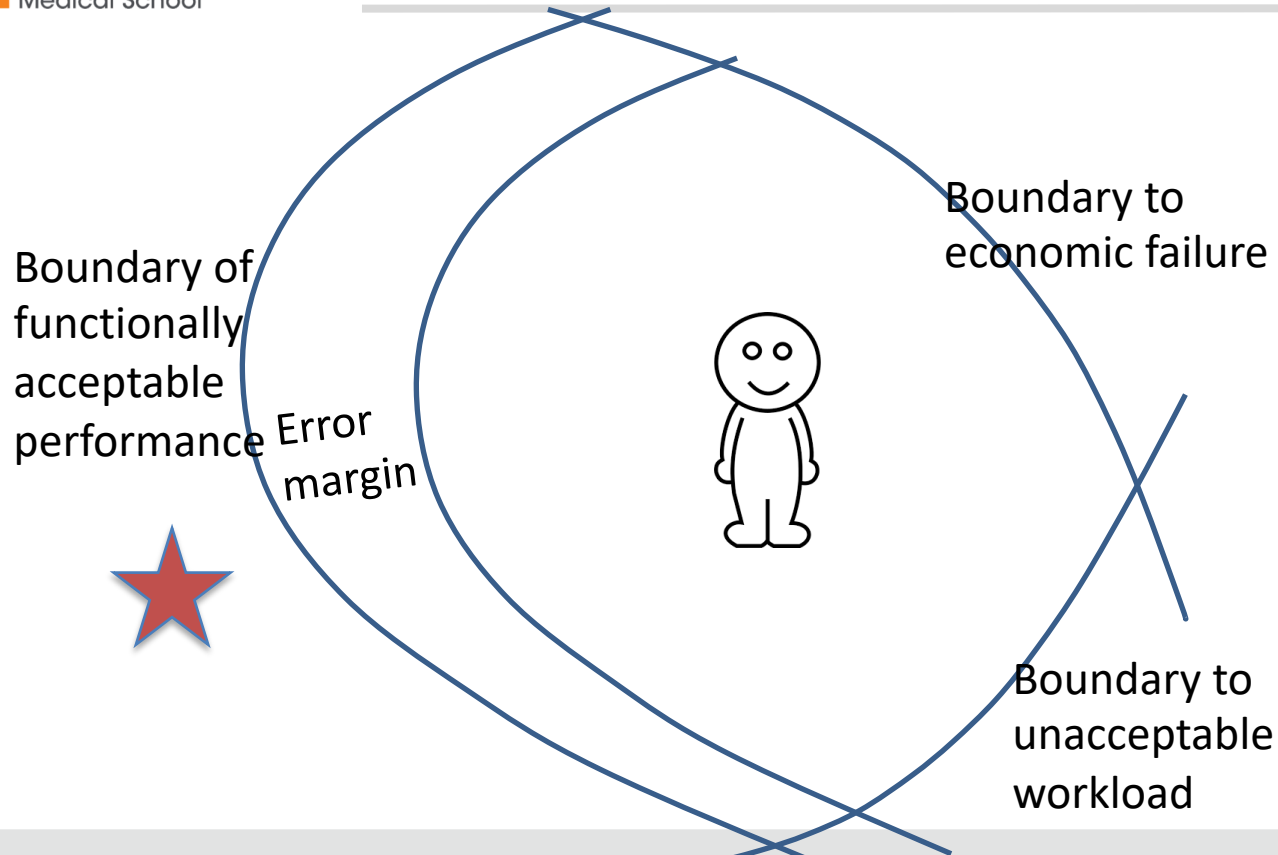
Sharp end workers

**Senior
management**

**People doing the
work**

- Workplace is dynamic
- SOPs and instructions are restrictive cannot deal with every changing demand
- Human behavior at work is strongly controlled by goals and constraints
- Workers make adjustments to how they work to meet production and safety demands
- This variability is called “degrees of freedom”
- Rasmussen used a model of boundaries to plot this variability in work performance

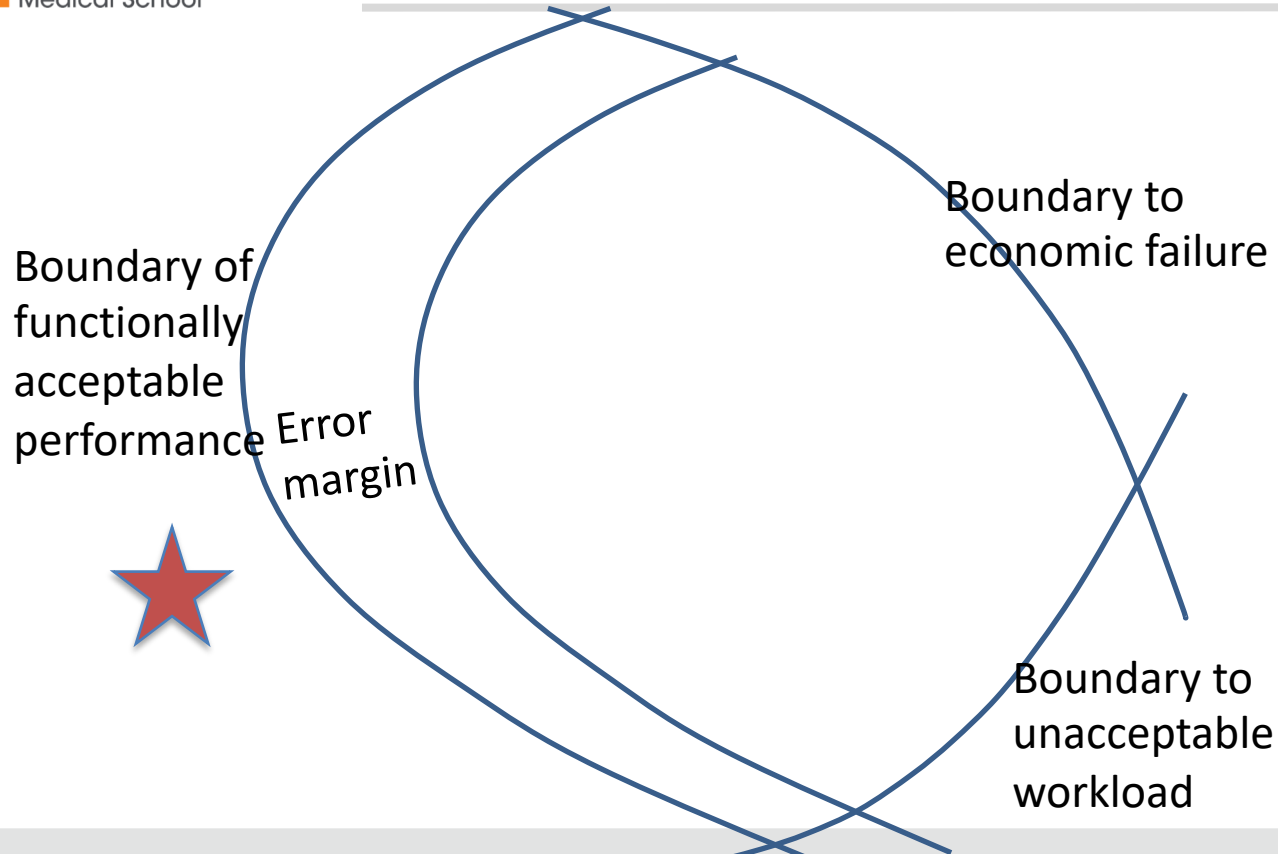
Rasmussen model of boundaries

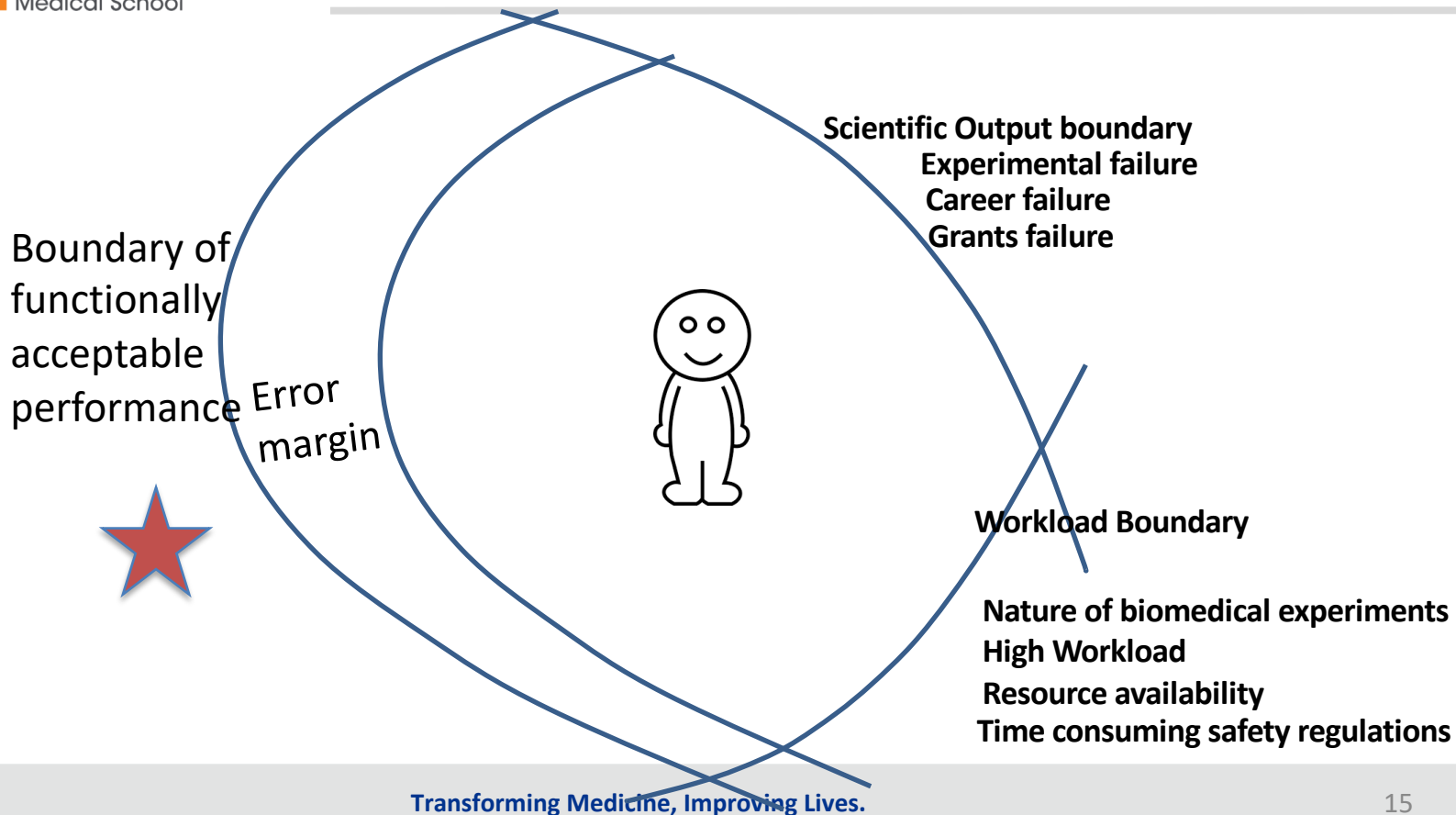


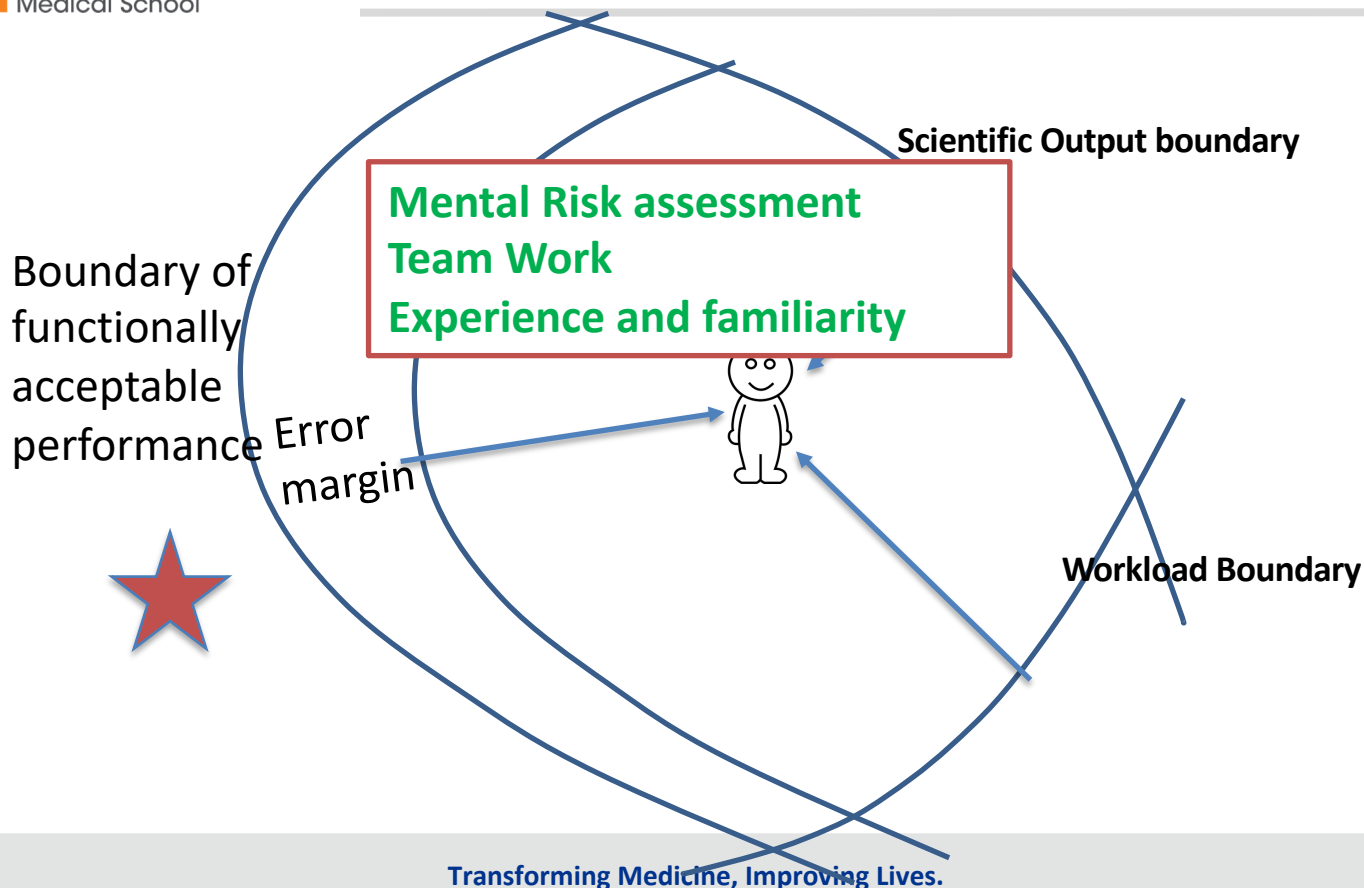
15 participants from biomedical laboratories interviewed using a one-on-one semi-structured method

- **Lab/ organizational goals**
- **Production pressure**
 - **How did that affect the planning of your experiments?**
 - **How did that affect how you conducted the experiments?**
- **What were the important trade-offs?**
- **Have you even been close to a safety incident or accident?**
 - **How did you know that it was getting dangerous.**
 - **How did you get there?**
 - **How did you correct yourself?**
- **Have you ever been close to a burnout or sick leave due to stress?**

Rasmussen model of boundaries







Counter gradients employed

Methods	Proportion of participants who mentioned the method (%) n=15	Boundary being avoided
Mental safety risk assessment	100	Safety boundary
Team work	100	All three boundaries
Experience and familiarity, which is achieved by the following:		Safety and scientific output boundary
• Mentoring by seniors	100	Safety and scientific output boundary
• On the job learning	100	
• Learning from accidents experienced by participant or colleagues	100	
• Sharing of experience and expertise through culture of open communication	100	
• Learning from safety information sheets and internet	53	

Mental Risk Assessment (what participants said)

- *I use the ranking system to assess the risk in my mind*
- *I will lose dexterity if I wear two gloves so sometimes I decide*
- *As I get more familiar I can optimize my routine and eliminate some steps that I have seen before that are not necessary*



Team Work (what participants said)

I work with nocturnal animals so you have to operate at night. It's about how you balance your sleep awake cycle and I think fatigue is the biggest problem because that's where accidents happen. It's not how you push the boundaries it's that we have to work at night because that's when these animals are active. So, we have to be able to watch out for each other"

Team Work (what participants said)

- *Multiple things have to be lined up, like a drama production with each player knowing what to do and others stepping in if one is unable to perform the task"*
- *"it is designed very precisely, you have a tight schedule. You cannot afford to make a mistake"*
- *"You definitely have to plan well, the way I see it it's like a choreography it has to be"*

Team Work (what participants said)

- *“catch the balls so that none fell to the ground”*
- *“so you reduce each person’s workload to a doable amount”*
- *“our team has a very good synergy if some of us are very tired, we will say let’s just process some of the samples. For example, if it is 2 am we will decide to stop blood taking and maybe we do swabs, so rather than take the risk and achieve the results we reduce the work”*

Experience and familiarity (what participants said)

- *“In the beginning, we need to do more carefully... Once you are fluent in the work then you can omit some steps”*
- *“We are now rescuing recombinant viruses that is a new thing for our lab, we did a fake rescue several times, there is no virus we practice without the risk”*
- *“What I am now is because of this one person in the lab who I learned from...”*

What is resilience engineering in safety

“Resilience is in the performance where a system is resilient if it can adjust its functioning prior to, during, or following events and thereby sustain required operations under both expected and unexpected conditions”

<http://erikhollnagel.com/ideas/resilience-engineering.html>



Duke-NUS:

400 researchers
44 hours a week
915,000 hours a year.
2016 - 26 cases of minor injuries.
Things that went right = 99.99716 %
Things that go wrong = 0.00284%

New View of Safety – is to support the workers who 99% of the time do the right things and prevent an accident

Hybrid Concept

Regulated safety

rule based non-negotiable
instructions, commensurate with
risk



Managed safety

based on their risk
assessment to suit dynamic
workplace demands

Safety is simply the way we work



Transforming Medicine, Improving Lives.