FT, PT, & AT

There is a growing need for…

*Agile training and integration strategies for engineering organizations with a **time**-diverse, **skill**-diverse, and **metaphysically**-diverse workforce.*

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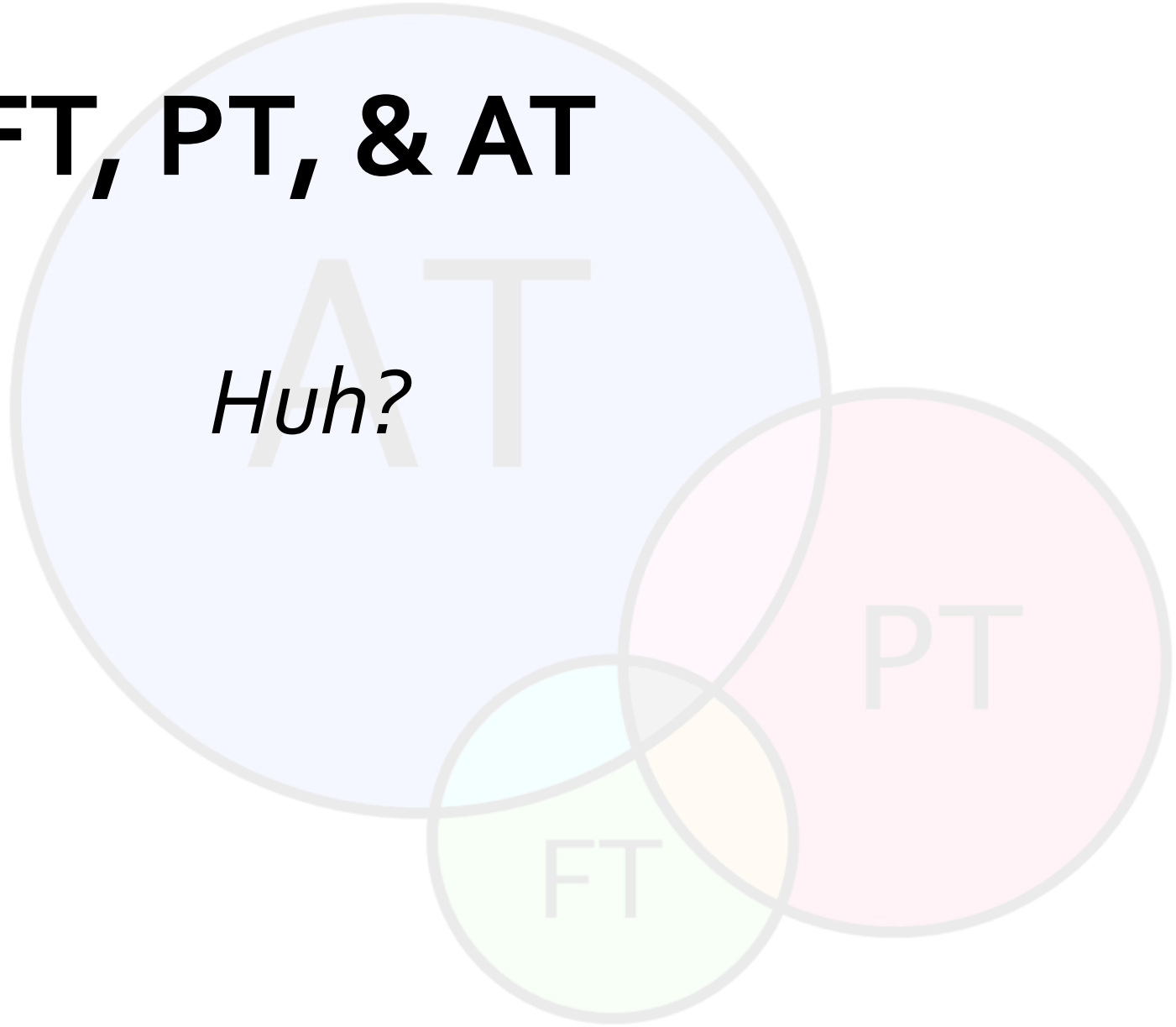
Huh?



Definitions

FT, PT, & AT: Full-time, part-time, and automation technology

Engineering organizations: Any system that works to solve large, complex engineering problems using science and technology (Colvin 25)

Workforce: Anyone adding value to the product or organization

Training & integration strategies: Anything that increases the workforce's ability to solve a problem or work together

Agile: Flexible, adaptive, and responsive

Definitions

Time-diverse: Full-time, part-time, contractors, consultants, etc.

Skill-diverse: Education, experience, abilities, and aptitudes.

Metaphysically-diverse: Humans vs. 'robots' (i.e., automation technology)

Project scope

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Agile training and integration strategies for engineering organizations with a **time**-diverse, **skill**-diverse, and **metaphysically**-diverse workforce.

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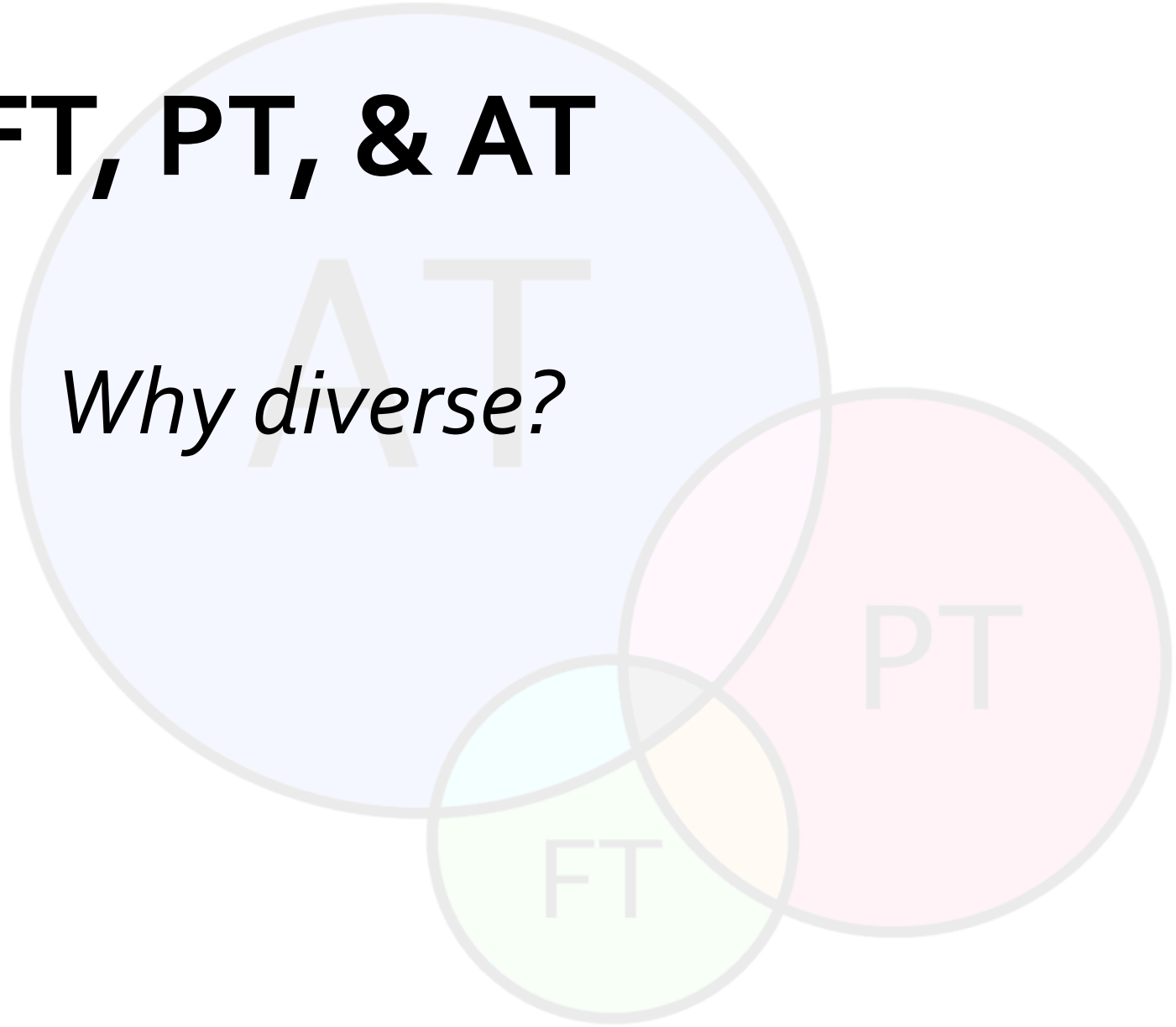
Why diverse?



Diverse workforce: sources: part-time

United States Bureau of Labor Statistics:

- 1968: ~5% of the population working part-time on a regular basis
- 2010: ~9% of population working part-time on a regular basis

"Employers often use contingent workers to surround a core of full-time workers"

- Part-time, temporary work, employee leasing, self-employment, contracting, home-based work, etc. (Saltford 7)

Part-time work is a major form of employment for three demographic groups: younger workers, older workers, and female workers (Saltford 15)

Diverse workforce: sources: automation

Computerization no longer confined to routine manufacturing tasks

- 2004: Self-driving cars declared insusceptible to automation
- 2010: Google announces fully autonomous cars

(Frey 3)

"Robotic trading (on Wall Street) progressed beyond the control – and comprehension of humans who designed the systems"

(Ford Chapter 4)

Diverse workforce: sources: automation

Advancements in "genetic programming" have allowed machines to

- Design electronic components
- Compose music
- Make art

(Ford Chapter 4)

Diverse workforce: looming crisis

- Offshoring often precursor to automation & automation makes offshoring easier

- Knowledge-based jobs can often be automated using only software (may be easier than low-skill labor requiring physical manipulation)

- (1) Analyze historical data, (2) incorporate machine/self-learning and track manual work, (3) replace worker

(Ford Chapter 4)

Diverse workforce: STEM

Engineering and science occupations likely to postpone automation the longest because of the need for machines to have a high-level of:

- Creative intelligence
- Social intelligence

(Frey 41)

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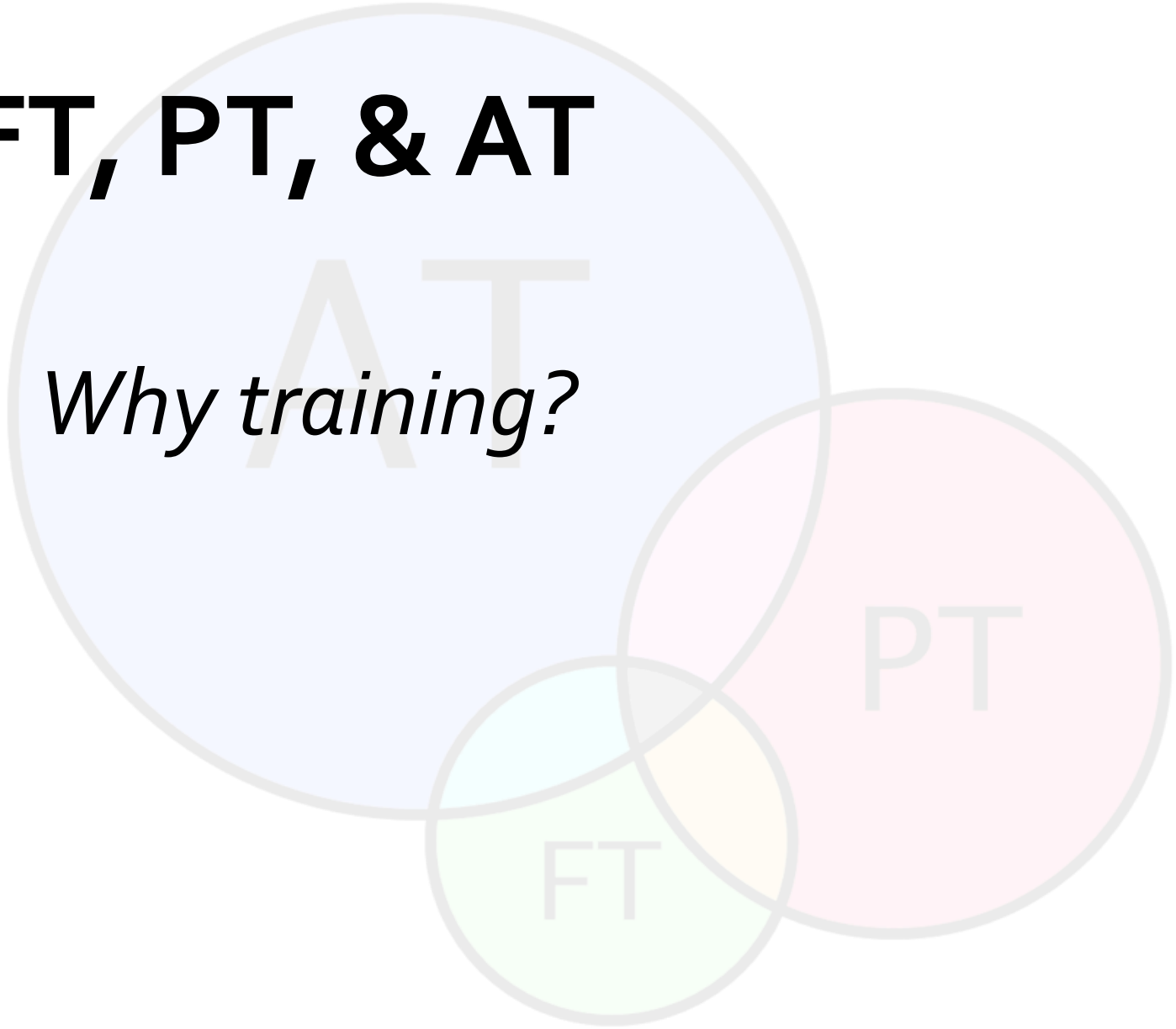
Why training?



Training and integration focus: demand

Part Time Work **Pros**:

- Employer: Commitment/Loyalty, Scheduling Flexibility, Growth in Increments, Business Peaks Management of Labor Costs
- Employee: Flexibility, Supplemental Income, **Personal Development**, Employment, **Introduction to the Work Force**

Part-time Work **Cons**:

- Employer: **Company Specific Knowledge/Continuity/Productivity**, Commitment, **Cost Effectiveness**
- Employee: Compensation, Job Security, Employee Benefits, Legal Protection

(Saltford 29-33)

Training and integration focus: theory

- Altering the mindsets/paradigms, goals, change power, rules, and access to information of the workforce will have the most leverage to change a system (Meadows)

- "Standardized work is the basis for empowering workers and innovation in the work place."
- "By contrast, enabling systems are simply the best practice methods, designed and improved upon with the participation of the work force. The standards actually help people control their own work."

  (Liker Chapter 12)

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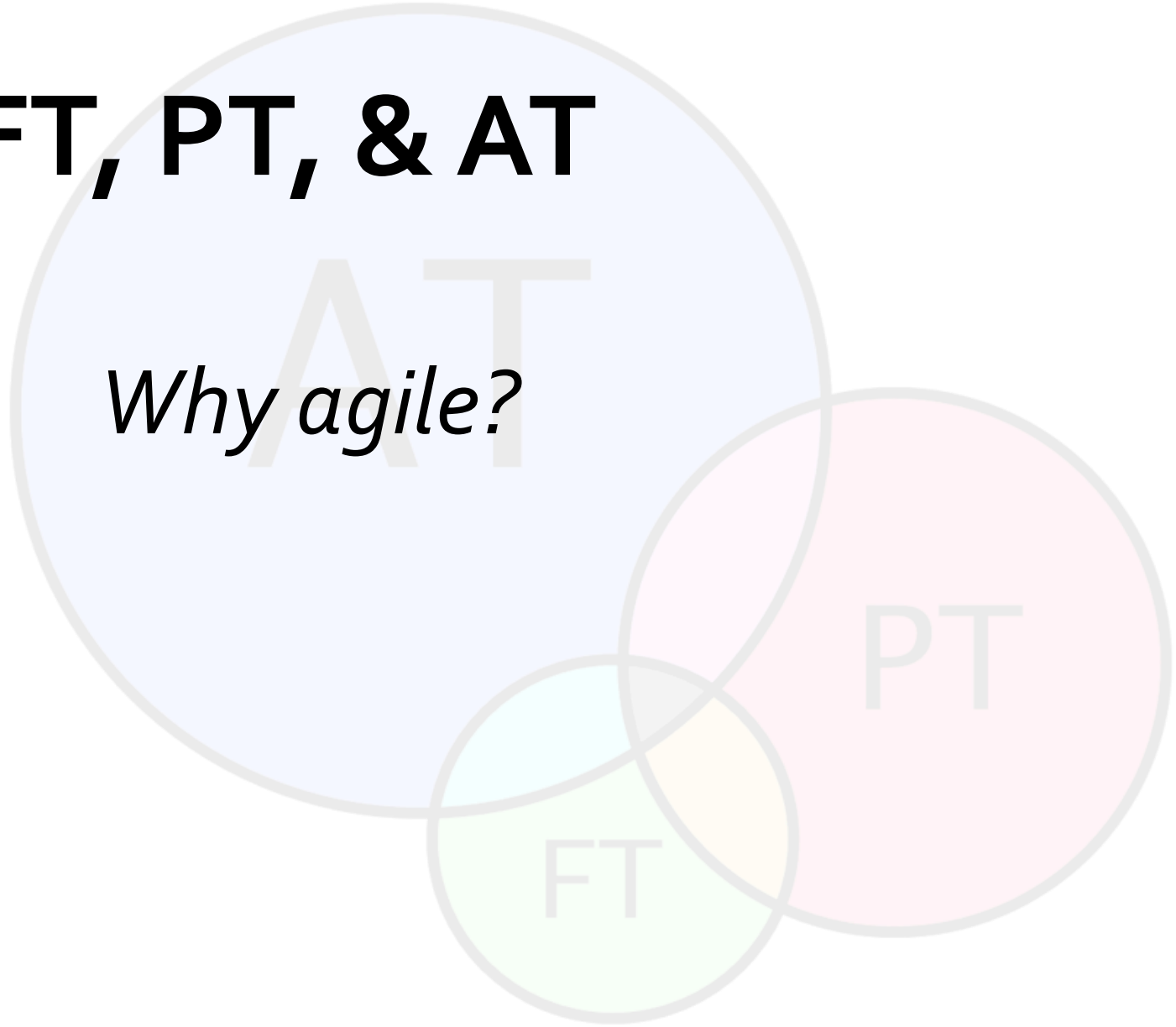
Why agile?



“Agile” in software development

“We are uncovering better ways of developing software by doing it and helping others do it. We value:

- Individuals and interactions over processes and tools.
- Working software over comprehensive documentation.
- Customer collaboration over contract negotiation.
- Responding to change over following a plan.“

(Fowler 2)

Agile applicability

- Continuous contact
- Continuous retrospection
- Self-organizing
- Value-based

- "One powerful approach offered by agile software developers lies in the incremental collection of information that turns uncertainty into probability and thus moves it closer to certainty." (Dönmez 198)

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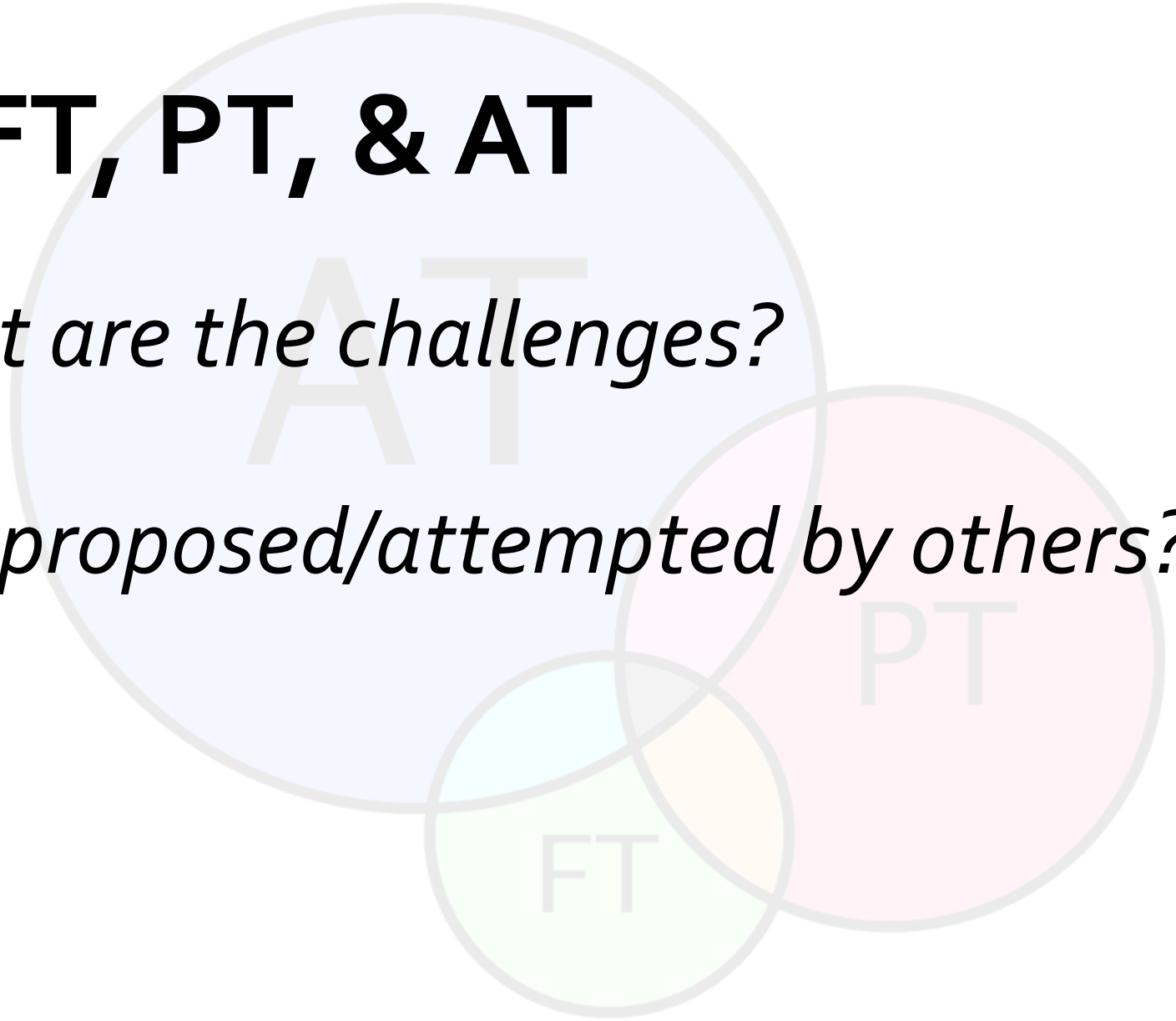
What are the challenges?

What has been proposed/attempted by others?



Training and integration challenges

- Requires flexibility in training schedule (Donovan 256)
- Need for training to include career / professional / skill development (Donovan 256)
- Must be carefully planned and use information technology to facilitate clear and timely communication of tasks and expectations (Chua 254)
- In "triangular employment relations", need to agree who trains what (Kalleberg 358)
- In "Industry 4.0" (Hermann 3929) even the automation technology will require training to allow it to adapt; and the people must adapt to the automation changes.

Training and integration challenges

Relying on part-time employees and automated technology shares 'outsourcing' challenges:

- More integration and assembly, less creation of components (Destifani 1)
- Loss of "tribal knowledge" (Destifani 3)
- Can lose ability to understand and control capabilities (Handley 162)

Existing proposals

- "Successful part-time professionals establish routines to protect their time at work and rituals to protect their time at home." (Corwin 124)

- "It seems important that people should see the entire sequence from problem identification, analysis, solution synthesis, detail design, manufacture, test, modification and redesign until satisfactory performance is achieved." (Salter 3)

- "Design process, critical thinking, and problem solving are the three major aspects of technological literacy course content" (Jones 180)

Existing proposals

- "It is interesting that our non-engineering colleagues on campus are very concerned about our engineering students receiving a well-rounded education including a number of courses in social humanistic areas, but they are not concerned abut non-engineering students learning about and developing an appreciation for technology." (Tompkins 170)

- "Apprentices were confronted, sometimes painfully, with the results of their own design mistakes. They learned directly about the imperfections of reality, about squareness, flatness, roundness, bad fits and the difficulties of making things work. Few of these irritations occur in the computer simulations which are attractively cheap and safe for university students." (Salter 2)

- Temp-to-perm contracts to preserve mutually beneficial investment in the employee (Kalleberg 358)

Prior attempts: training non-programmers

Training of 10 non-programmers for a German insurance company in 10-months (Becker-Pechau 2):

- Concepts over API details
- Best tools for the task
- Learning by doing
- Permanent reflection
- Intense and personal feedback
- Soft skills as an explicit topic
- Iterative and incremental learning
- Learning environment close to future job setting

Prior attempts: logic design

Logic design course at UCLA for non-engineers (Nahapetian 80):

- Picked a topic with a shallow learning curve
- Had no prerequisites
- Focused on design and problem-solving over specific tools
- Tried to inspire interest and introduce cutting-edge research

Prior attempts: mitigate overspecialization

NASA Engineering Training Program: "Helping Engineers 'See' Better" on systems and system awareness (Patterson 1)

3-part system level model for engineering decisions:

- Recognize the problem, analyze the parts, and synthesize a proposal for the solutions

Systems engineering process focus:

- Planning and marketing
- Acquisition or development
- Research, development, test, and evaluation

Prior attempts: multi-disciplinary design

Introduction to Engineering Design Principles class at Penn State (Okudan 1287):

- Non-engineering and engineering students cross-train each other
- Project and team based
- Defined-outcomes that allow multiple solution pathways
  - E.g., "Design a product to make life better during or right after a hurricane."
  - E.g., "Design and build a collapsible floor lamp that can be used as a desk lamp."
- Clear links to pre-selected engineering concepts

Prior attempts: engineering studies minor

Establishment of engineering studies minor at Iowa State University (Mina 2007) that included the objectives:

- Perform simple calculations and estimations using engineering method
- Make simple cost-benefit and risk-benefit analyses
- Attain a basic understanding of the engineering design process
- Understand the capabilities and limitations of basic manufacturing processes and engineering systems

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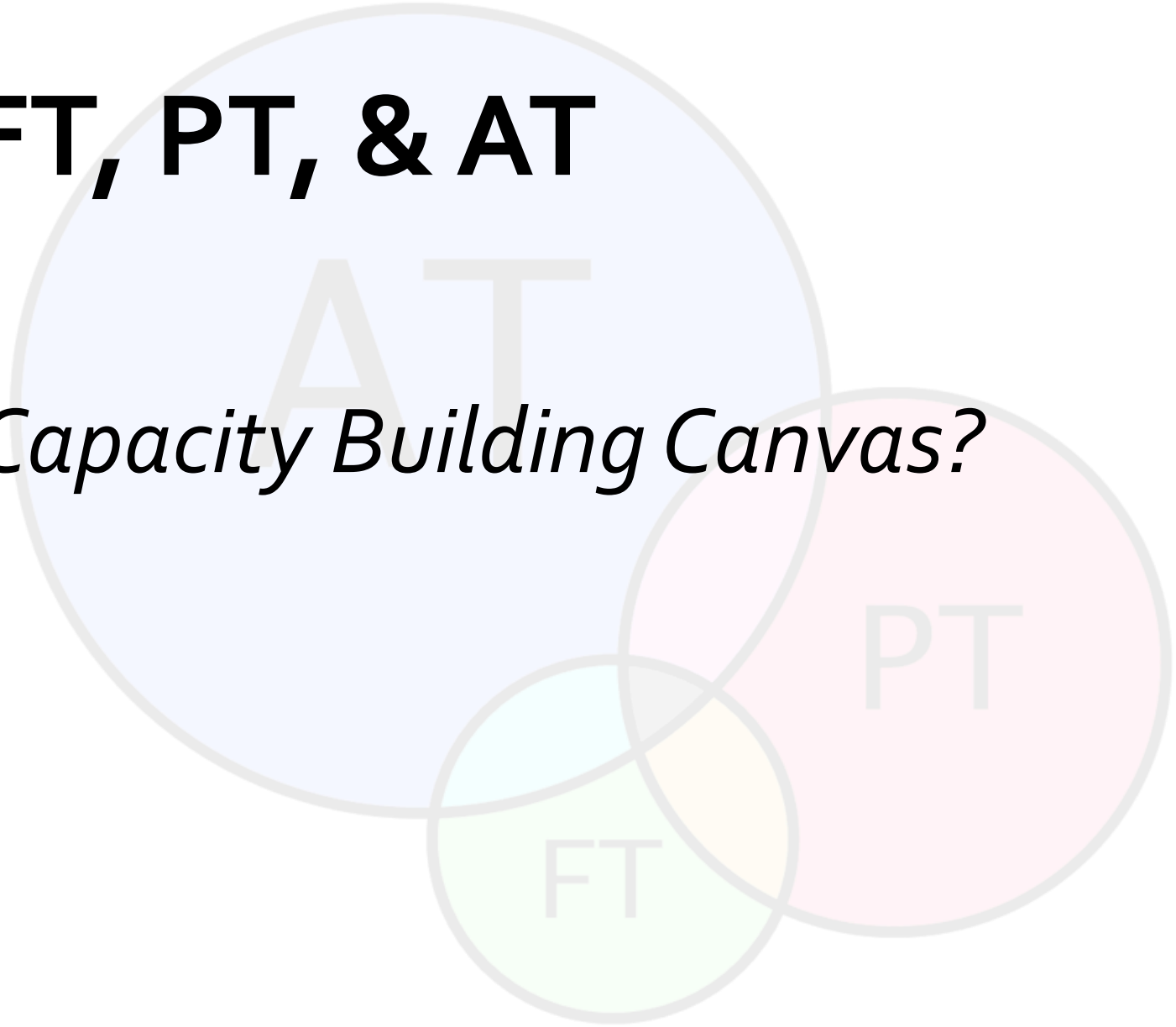
Why the Capacity Building Canvas?



Big question

How are we going to train all these FT, PT, and AT pieces to work together and solve the tough problems everyone assumes they are currently unprepared to solve (by virtue of education or humanity?)

Capacity Building Canvas

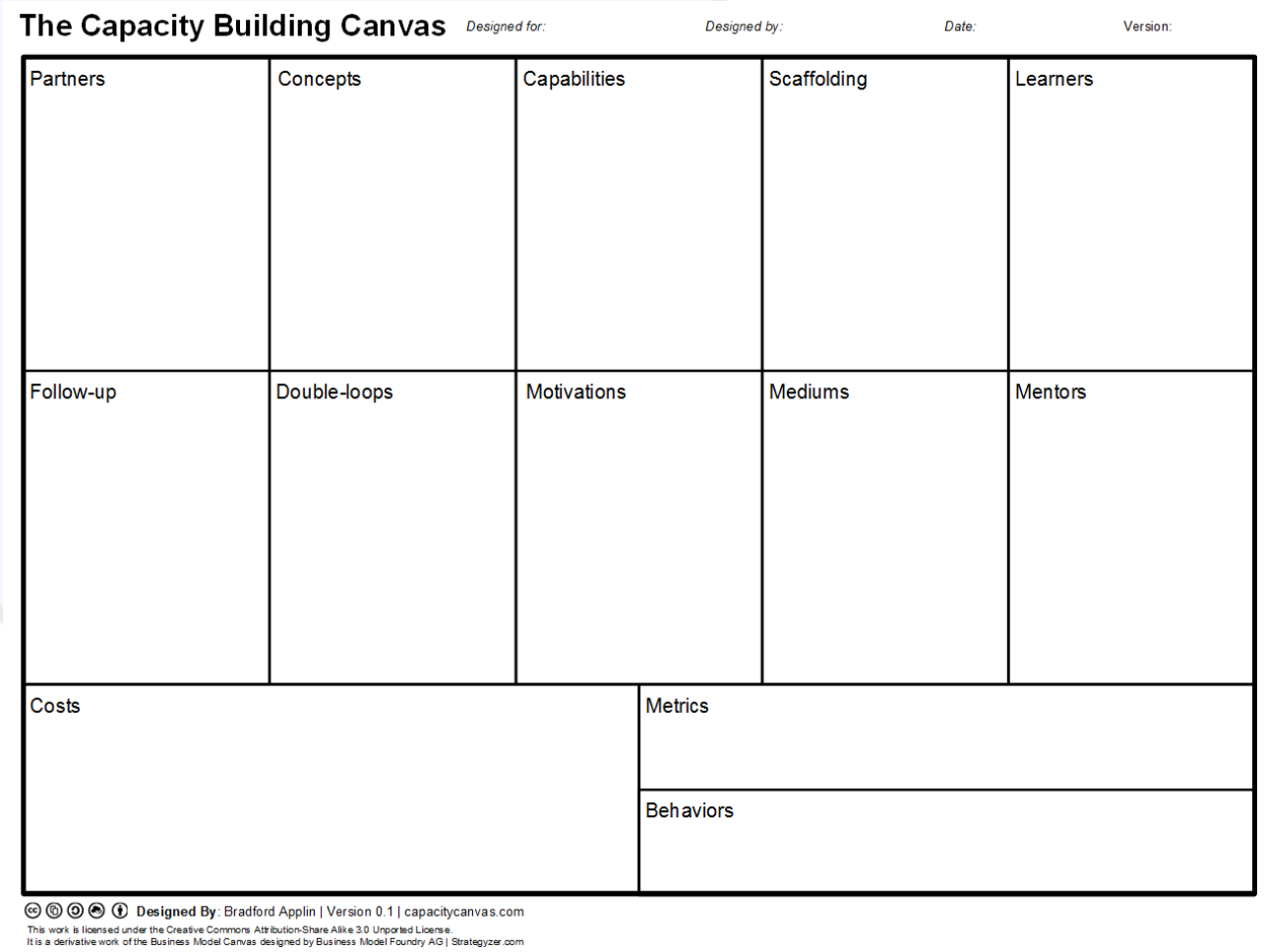
The capacity building canvas allows for trainings that…

- Iterate rapidly to respond to learner needs
- Adapt to changes in the organization
- Focus on motivations, capabilities, and results
- Invite learners to challenge their assumptions
- Create an environment for experimentation

More Information

For more information about the Capacity Building Canvas and to find out how you can participate,

please visit: www.capacitycanvas.com



The Capacity Building Canvas *Designed for:* *Designed by:* *Date:* Version:

Partners	Concepts	Capabilities	Scaffolding	Learners
Follow-up	Double-loops	Motivations	Mediums	Mentors
Costs		Metrics		
		Behaviors		

Designed By: Bradford Applin | Version 0.1 | capacitycanvas.com

This work is licensed under the Creative Commons Attribution-Share Alike 3.0 Unported License.
It is a derivative work of the Business Model Canvas designed by Business Model Foundry AG | Strategyzer.com

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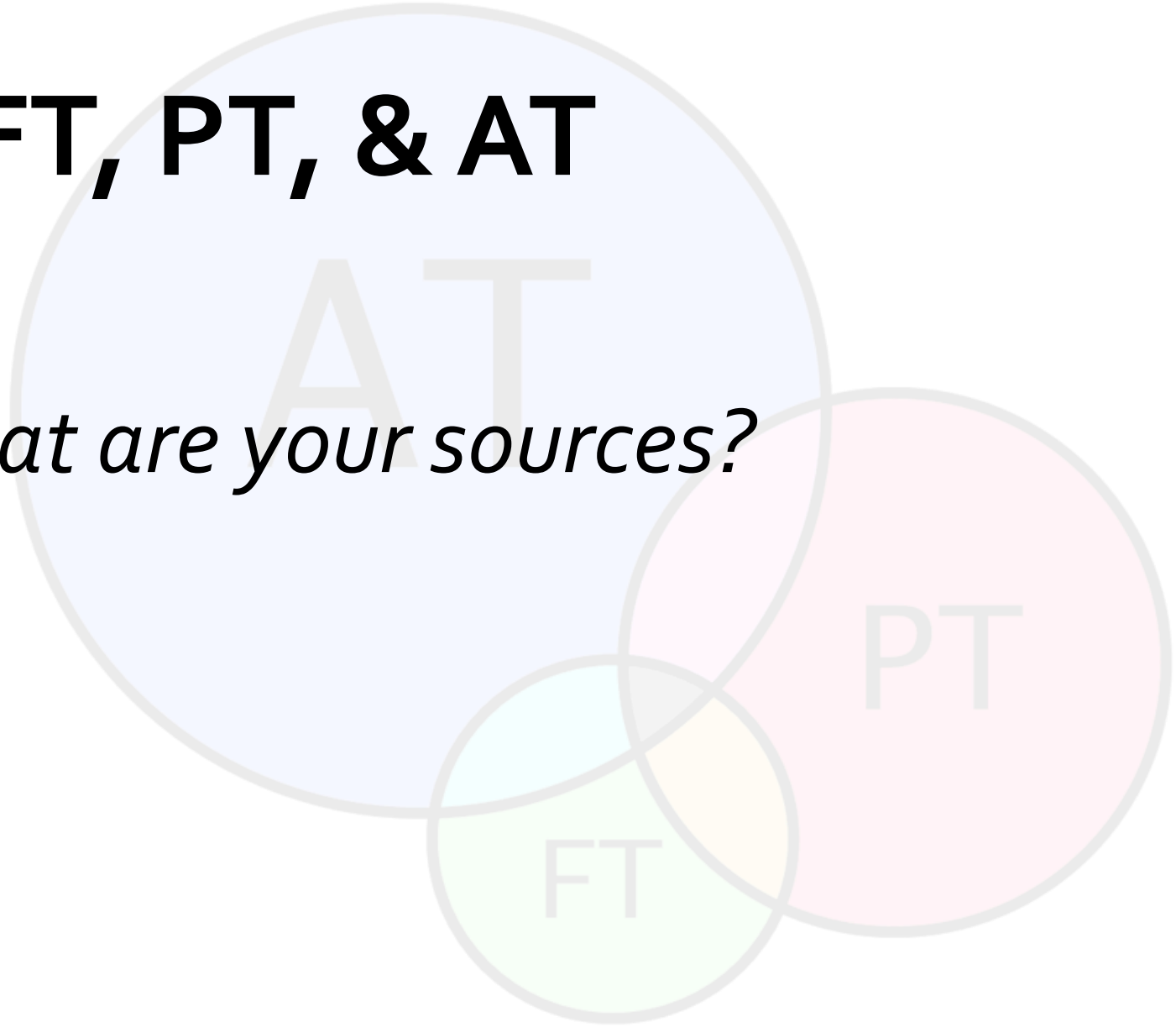
What are your sources?



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