

Cognitive Distraction & Attentional Error

Bringing Science to the Rail Industry

APTA Rail Conference

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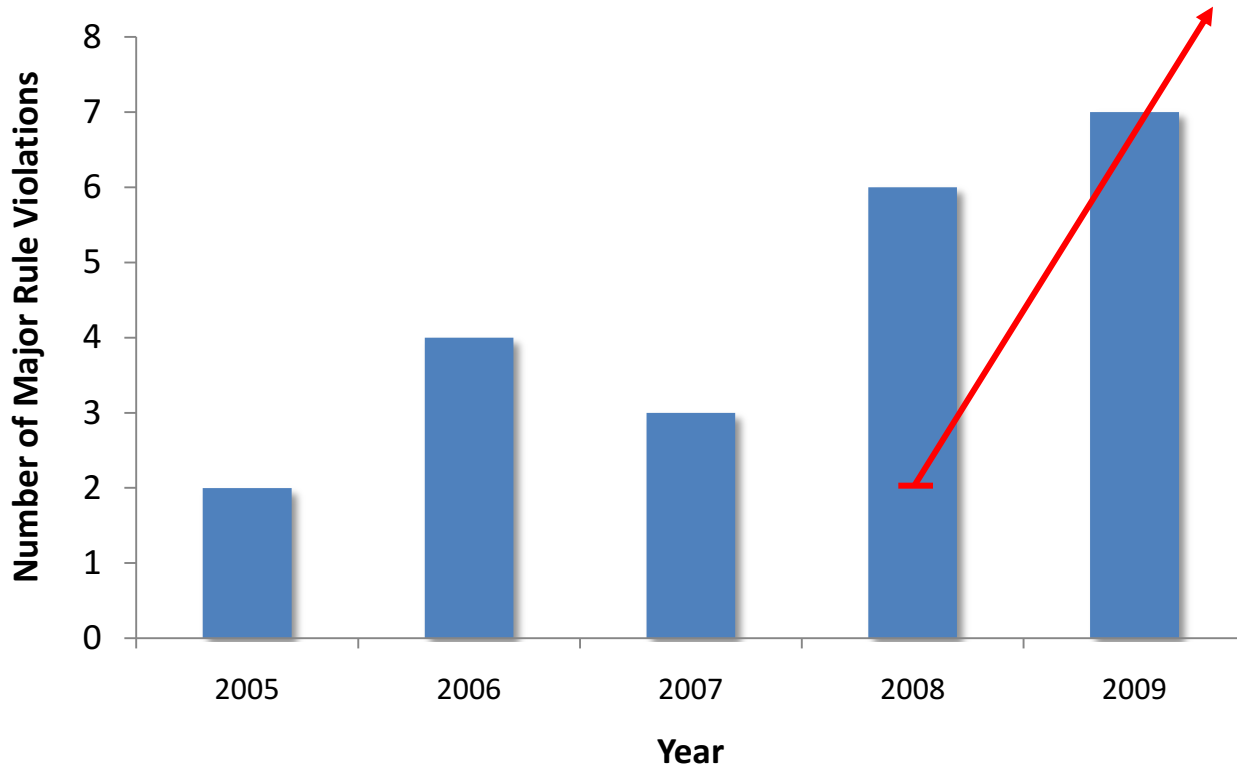
Agenda

- Background: Root Cause Analysis
- Major Rule Violations: *A Scientific Perspective*
- A Step Change in Safety Performance
 - A New Perspective on Employee Responsibility
 - A Paradigm Shift for Management
- Opportunities
- A Path Forward

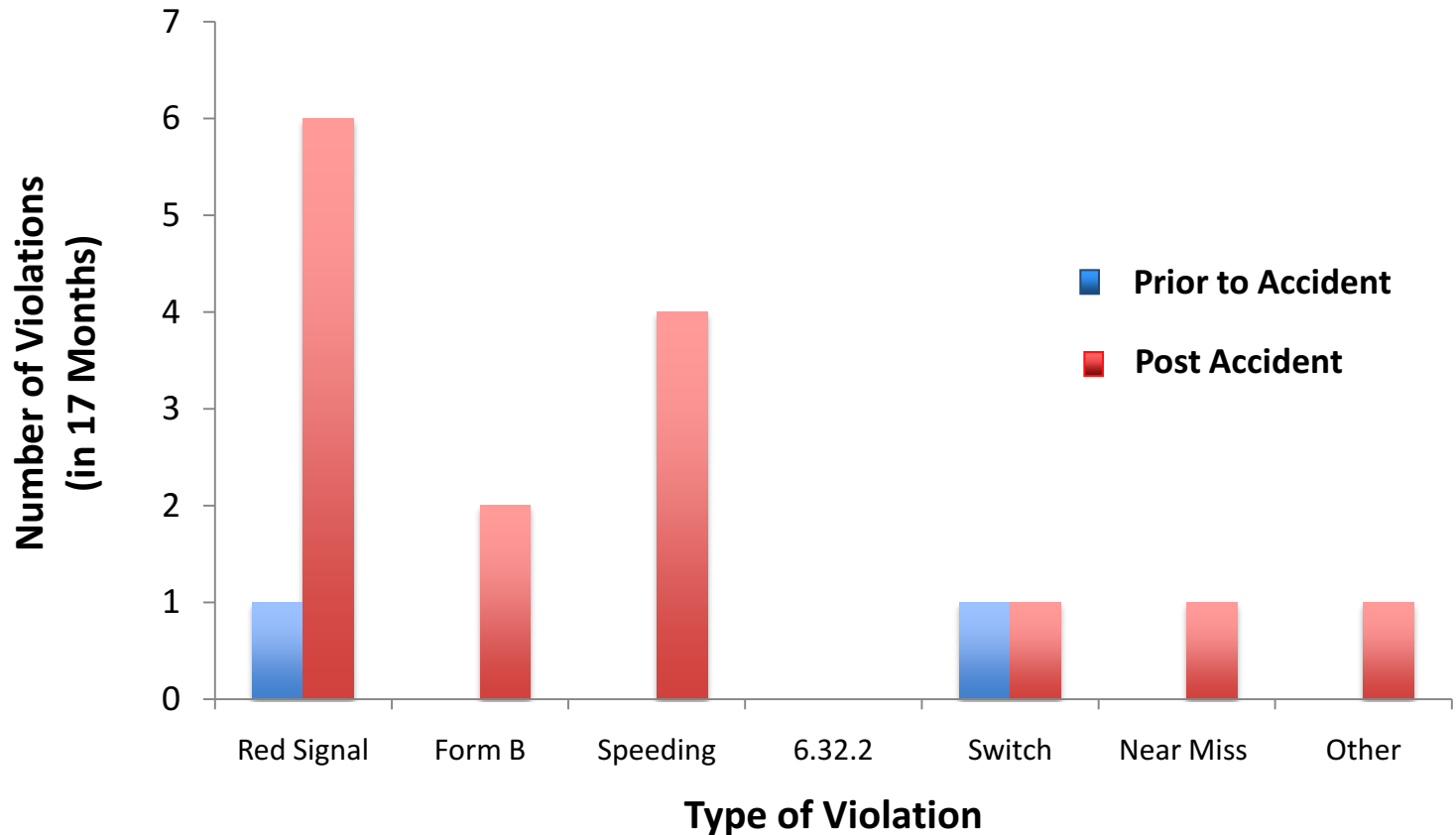
Background: Root Cause Analysis

- Major Rule Violations (Q4 2009)
 - Uncertainty as to cause(s)
 - Lack of consensus on corrective action
- Root Cause Analysis (2009 – 2010)

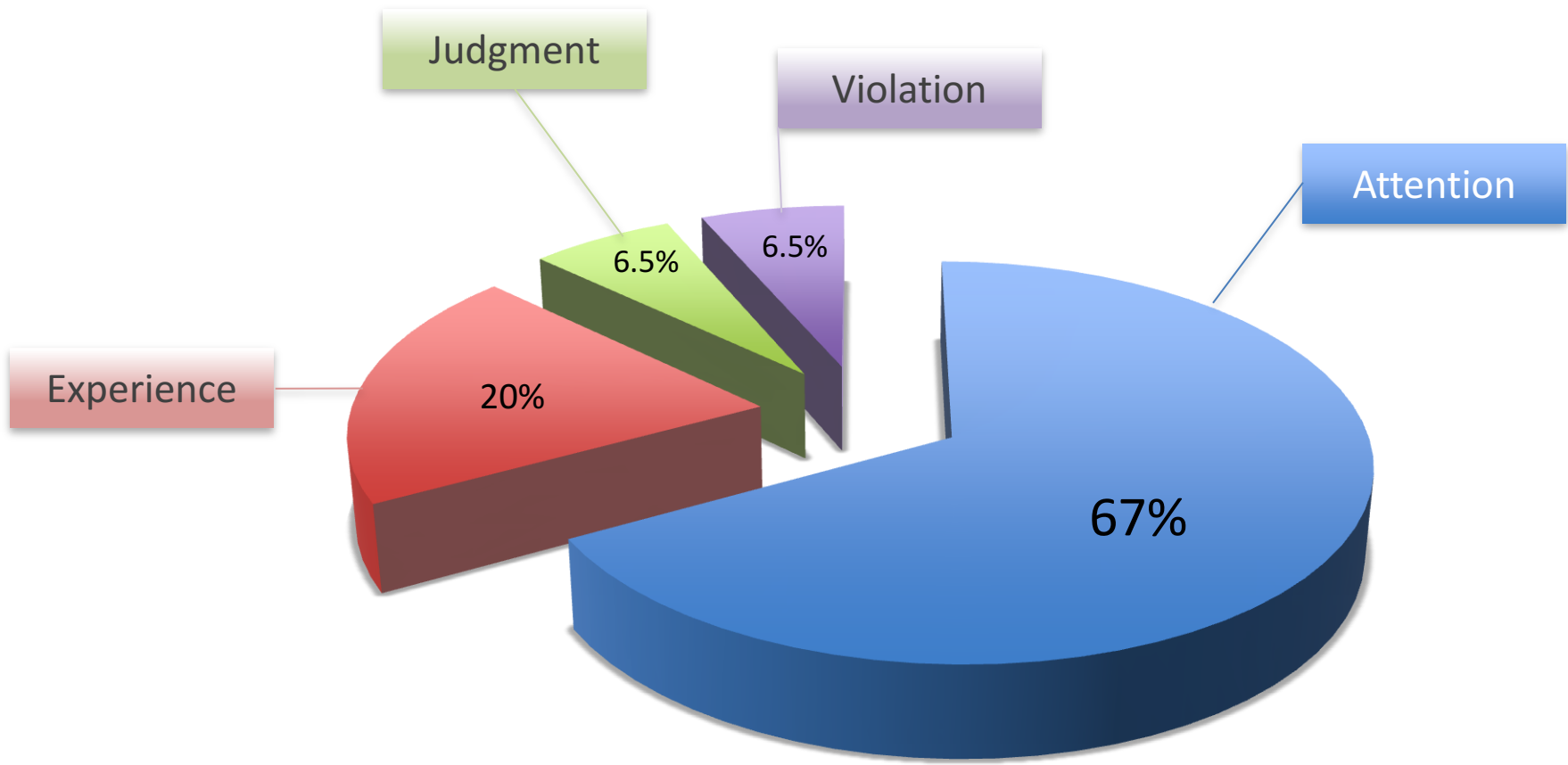
Major Rule Violations 2005 – 2009



Major Rule Violations Prior & Post Accident



Causes of Major Rule Violations



Cognitive Distraction & Attentional Error

So what exactly are we talking about?

Cognitive Distraction & Attentional Error

“Instances where we are distracted or lose focus on the task at hand when...”

Cognitive Distraction & Attentional Error



... our attention wanders to a concurrent task(s)...

Cognitive Distraction & Attentional Error



... or to unrelated internal thought(s)...

Cognitive Distraction & Attentional Error



... or when we act automatically based on past experience regardless of the present circumstances”

Cognitive Distraction & Attentional Error

Workplace Distractions: The Anatomy of a Red Signal Violation

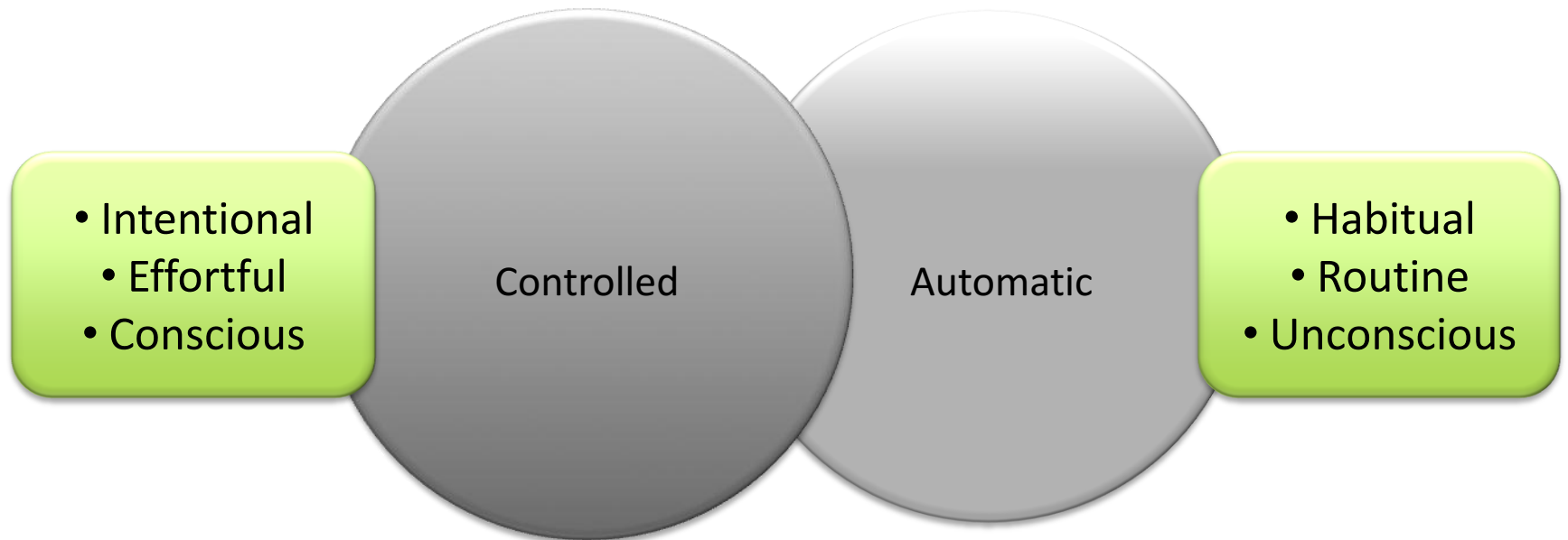
Cognitive Distraction & Attentional Error

Bringing Science to the Rail Industry

Human Limitations

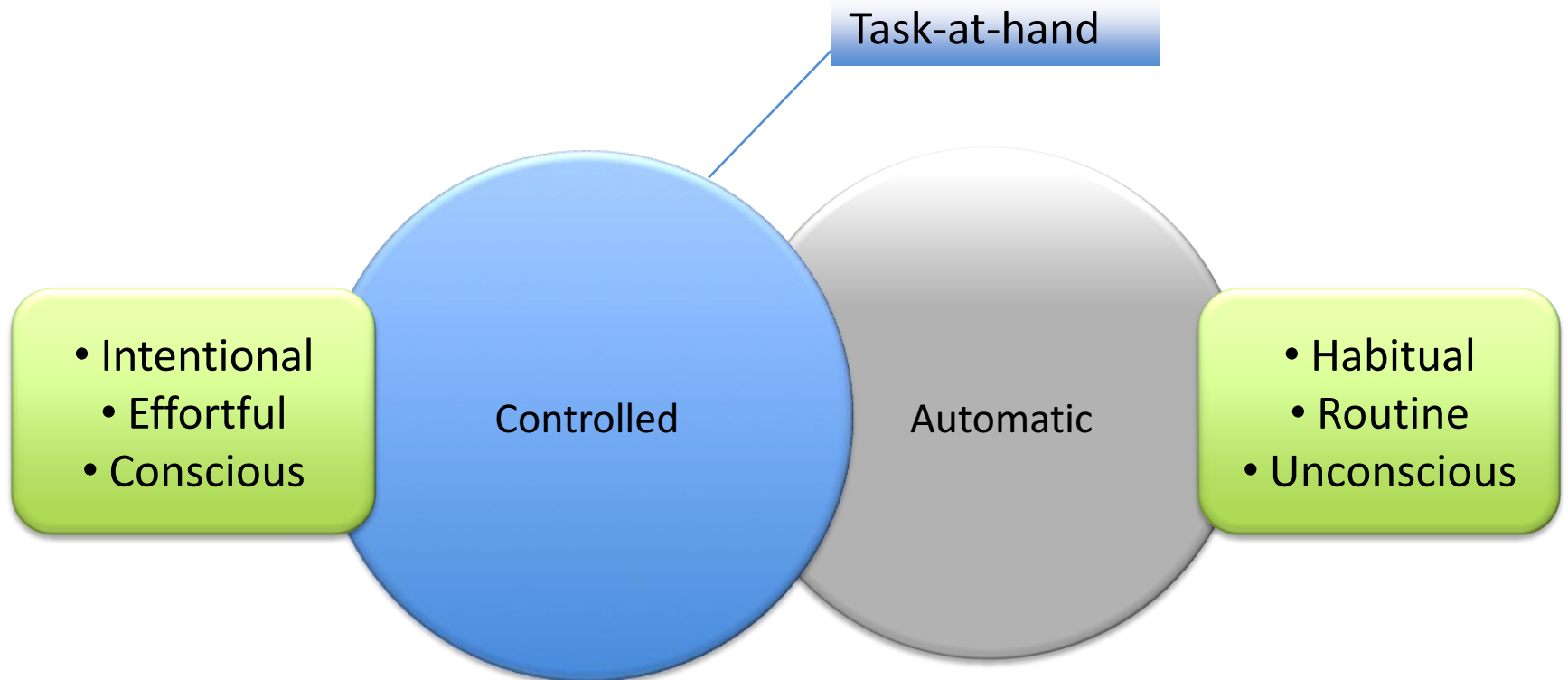


Attention: A Limited Resource



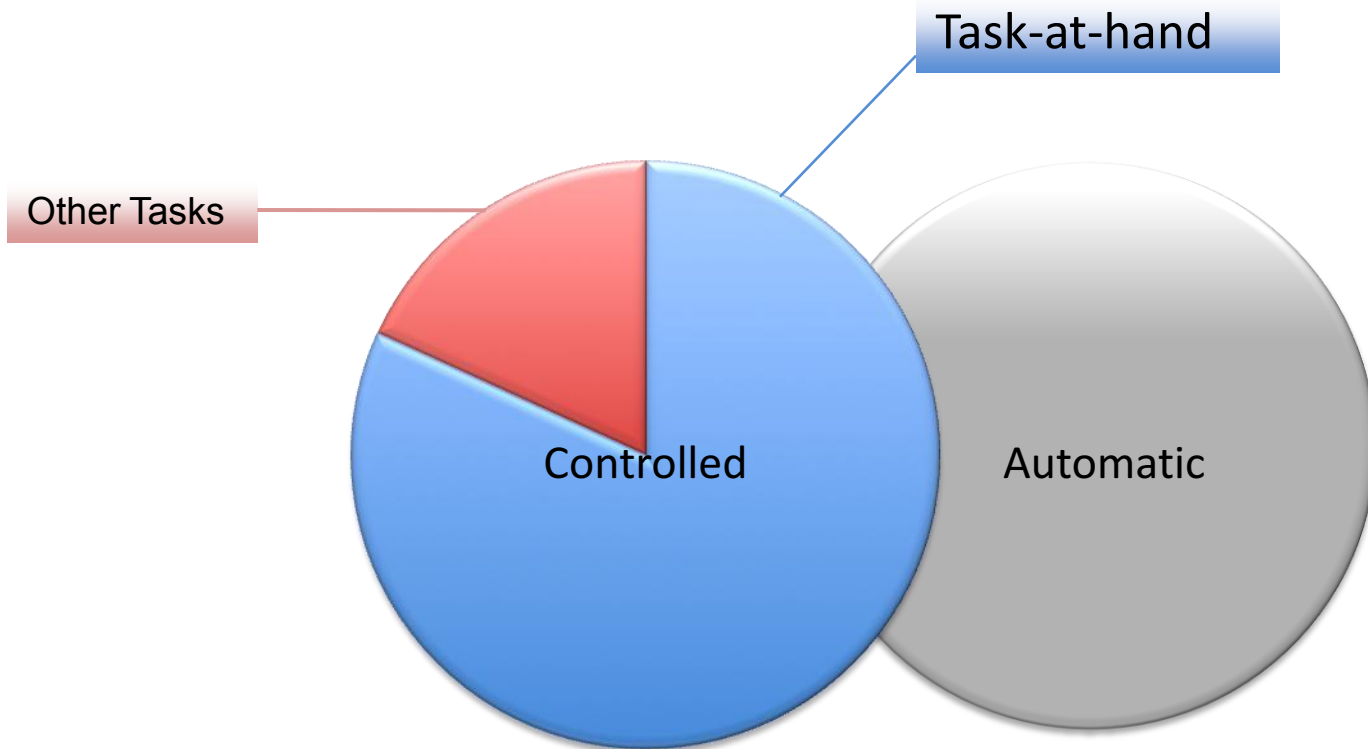
Behavior is governed by two distinct brain systems

Attention: A Limited Resource



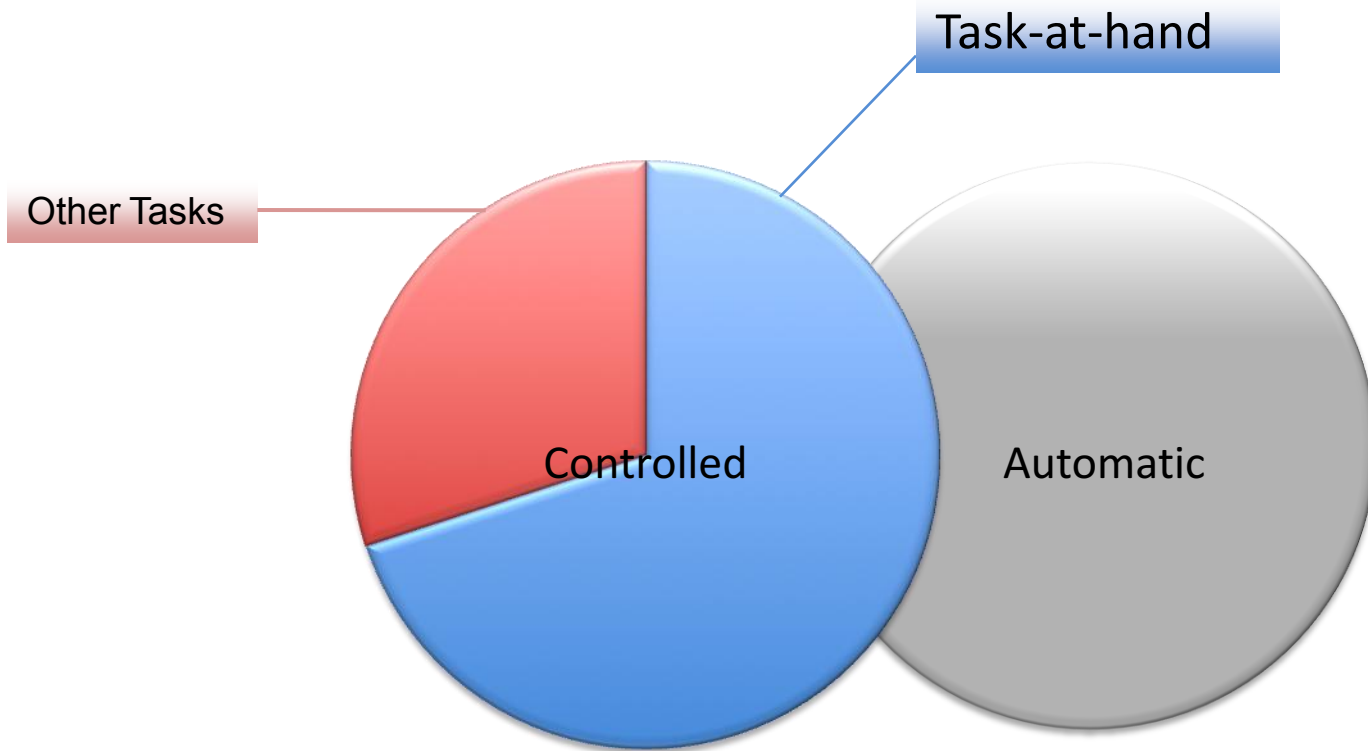
Behavior is governed by two distinct brain systems

Attention: Overload



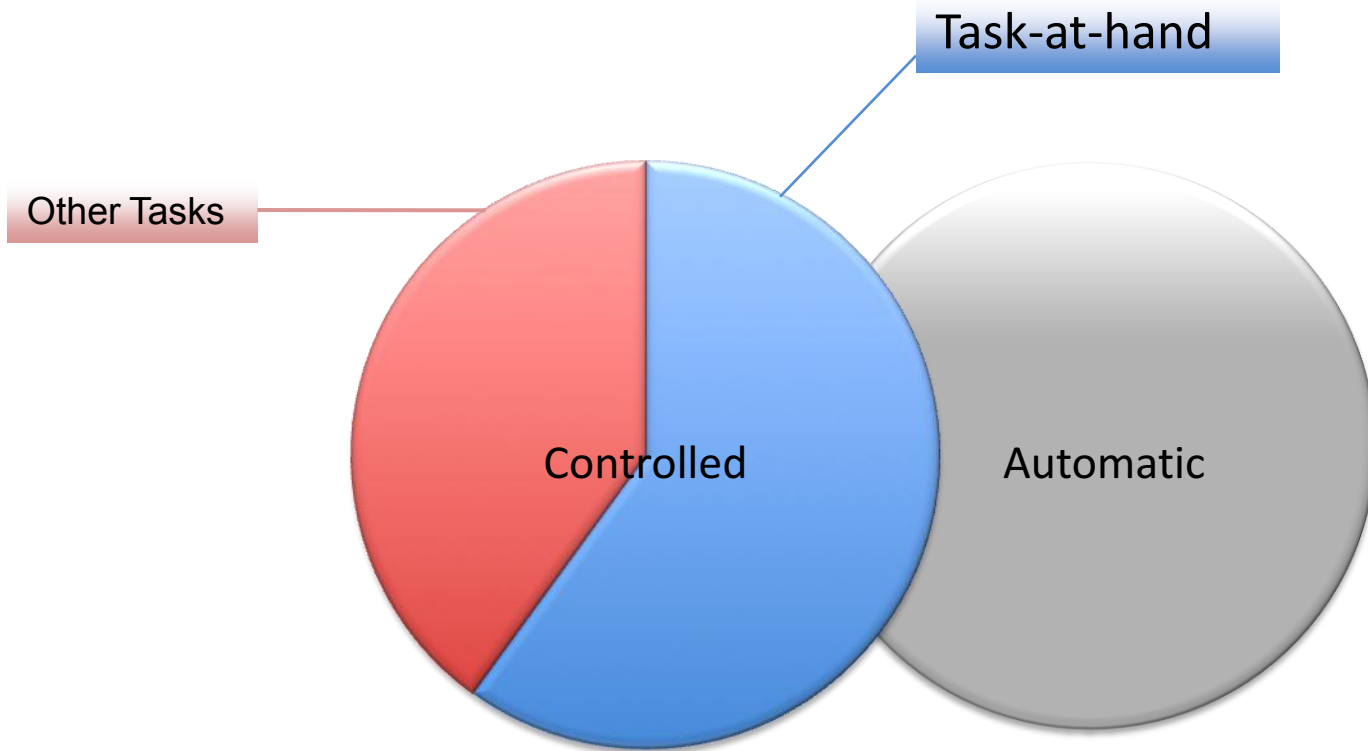
Other tasks take attentional resources away

Attention: Overload



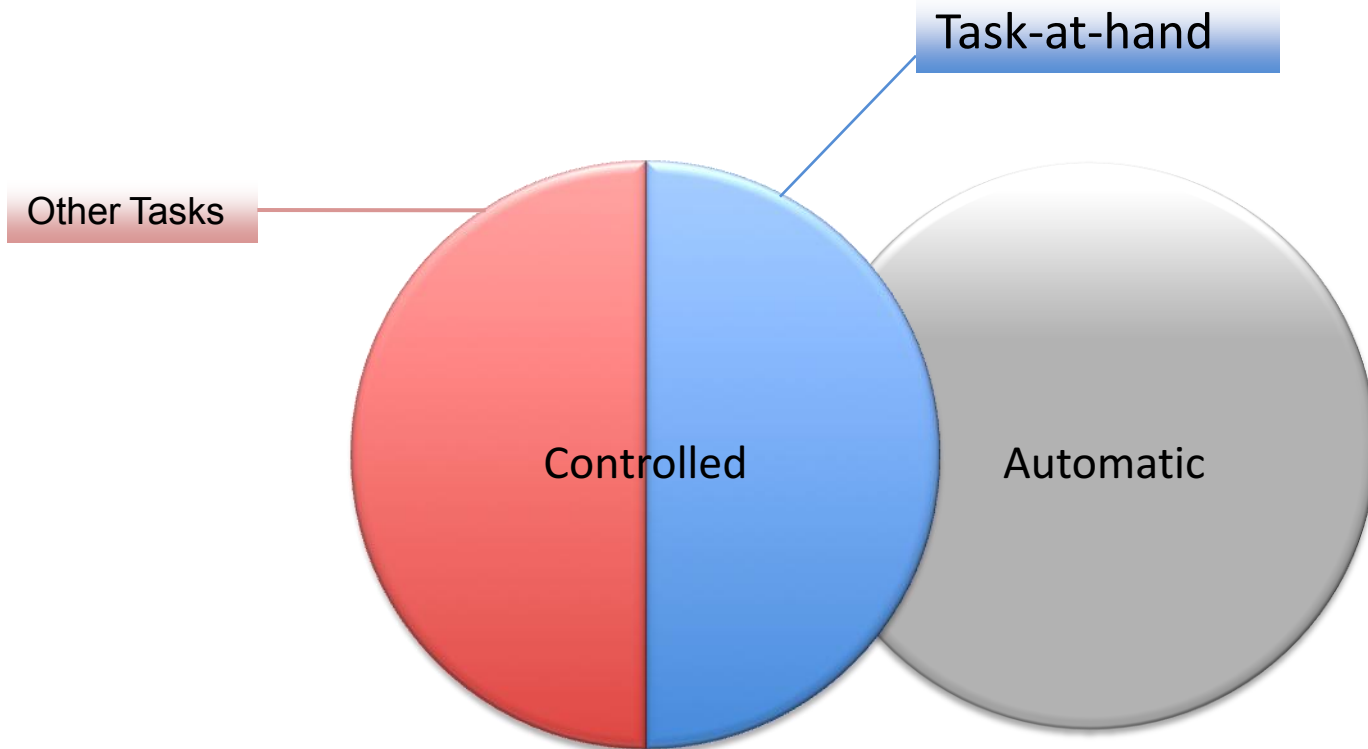
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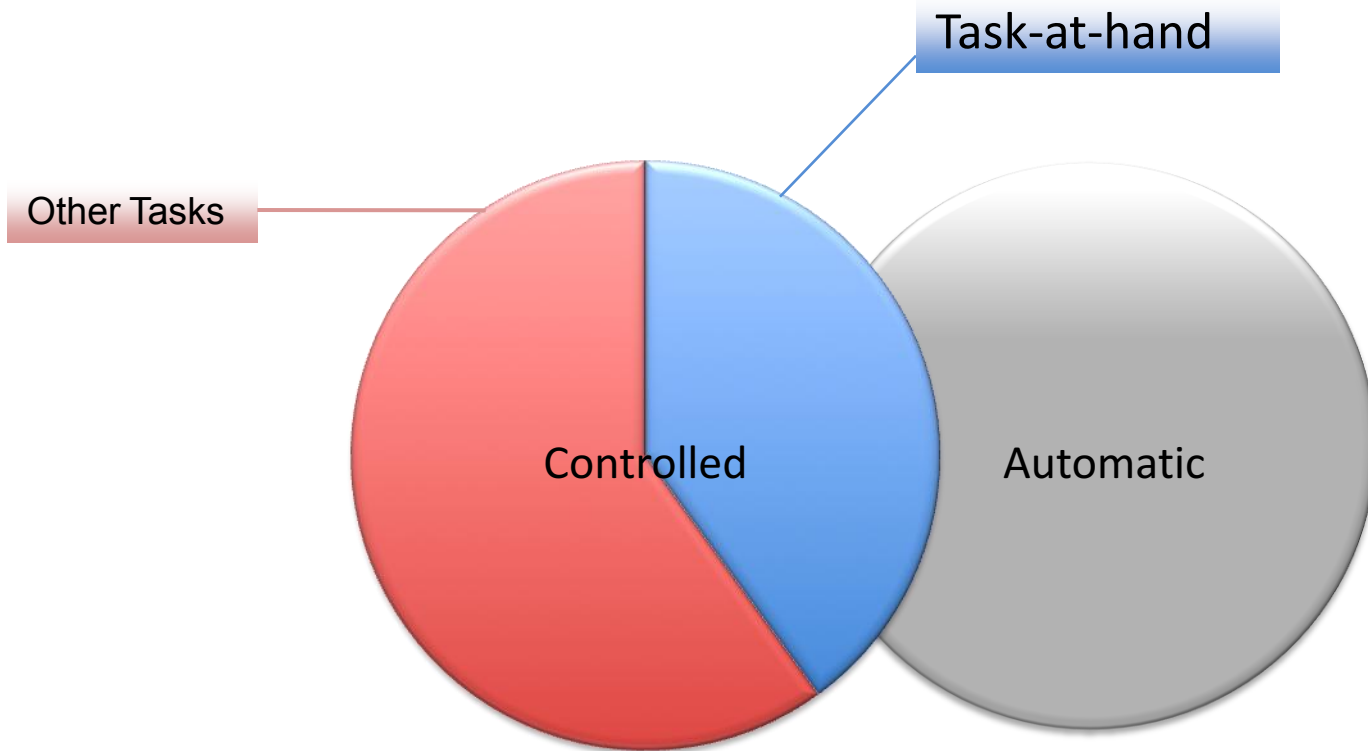
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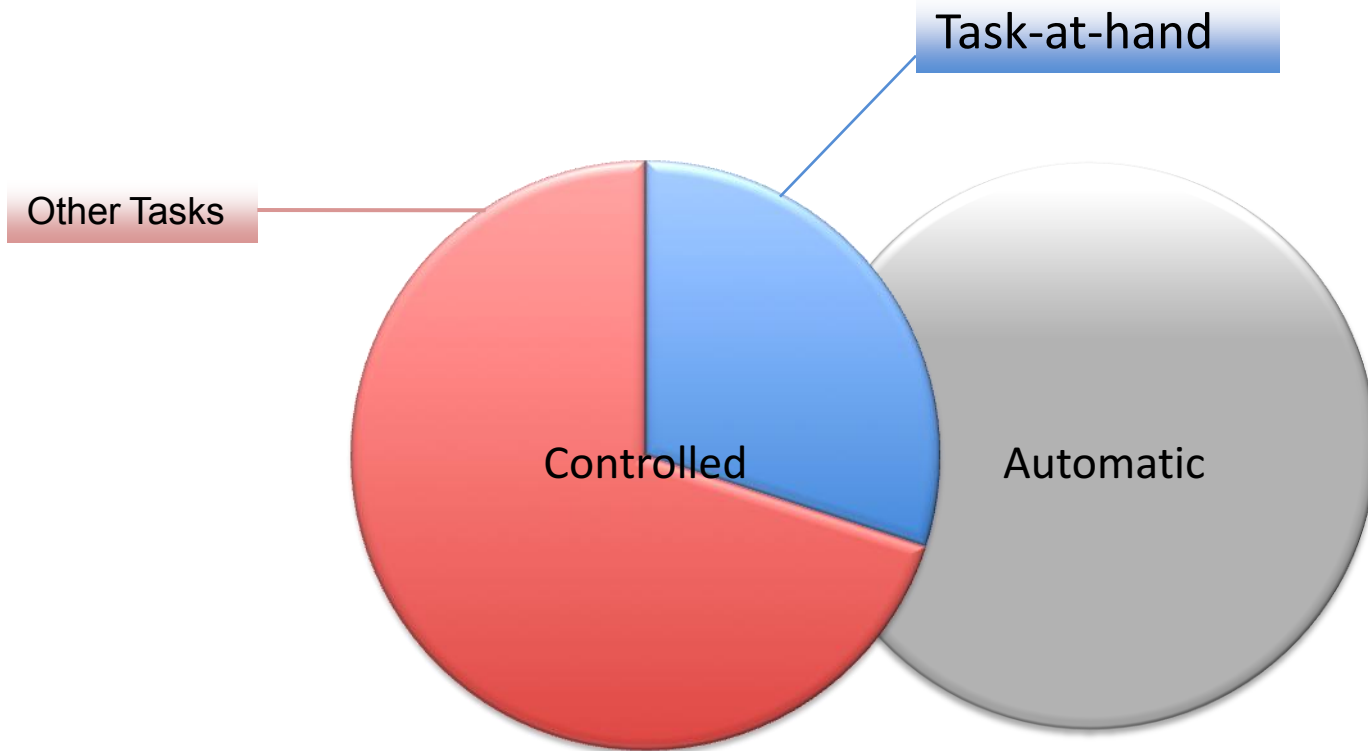
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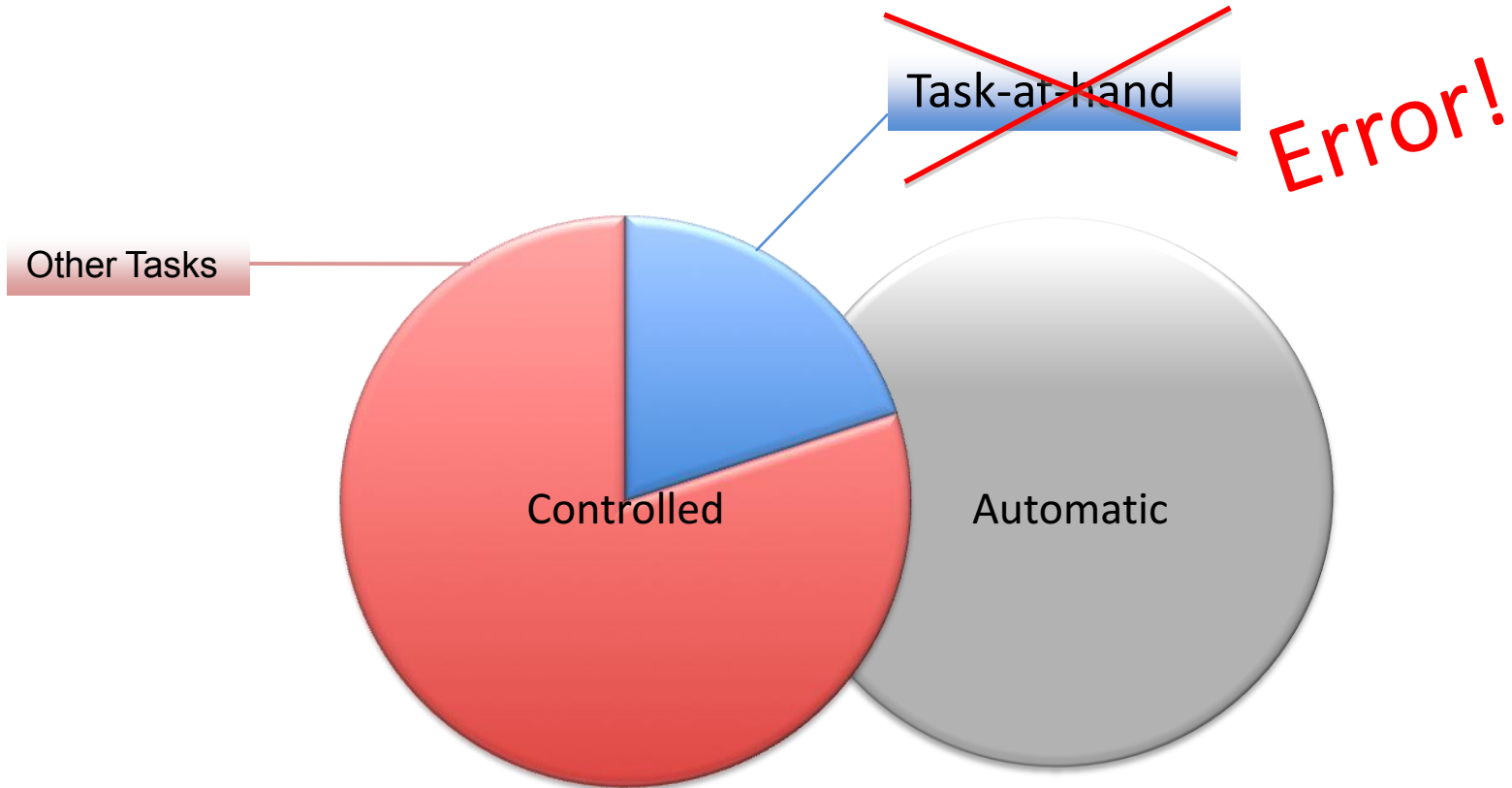
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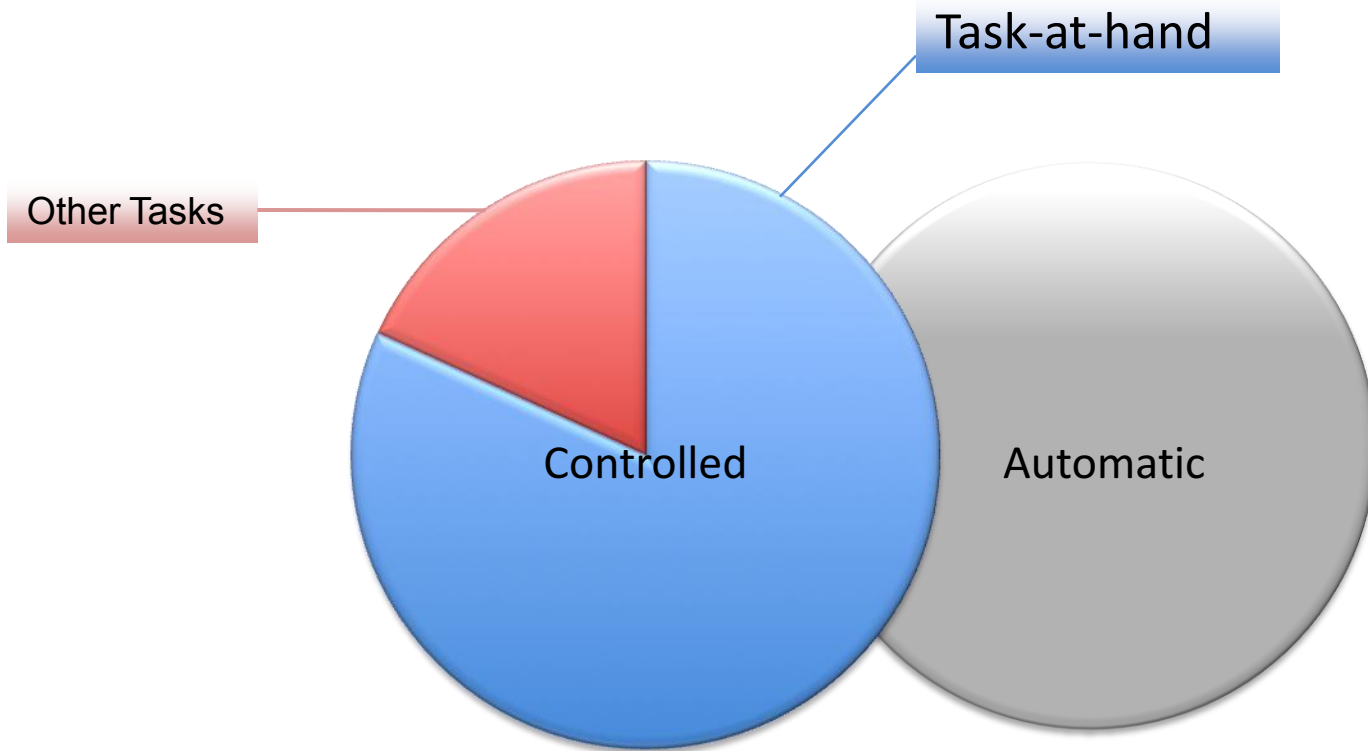
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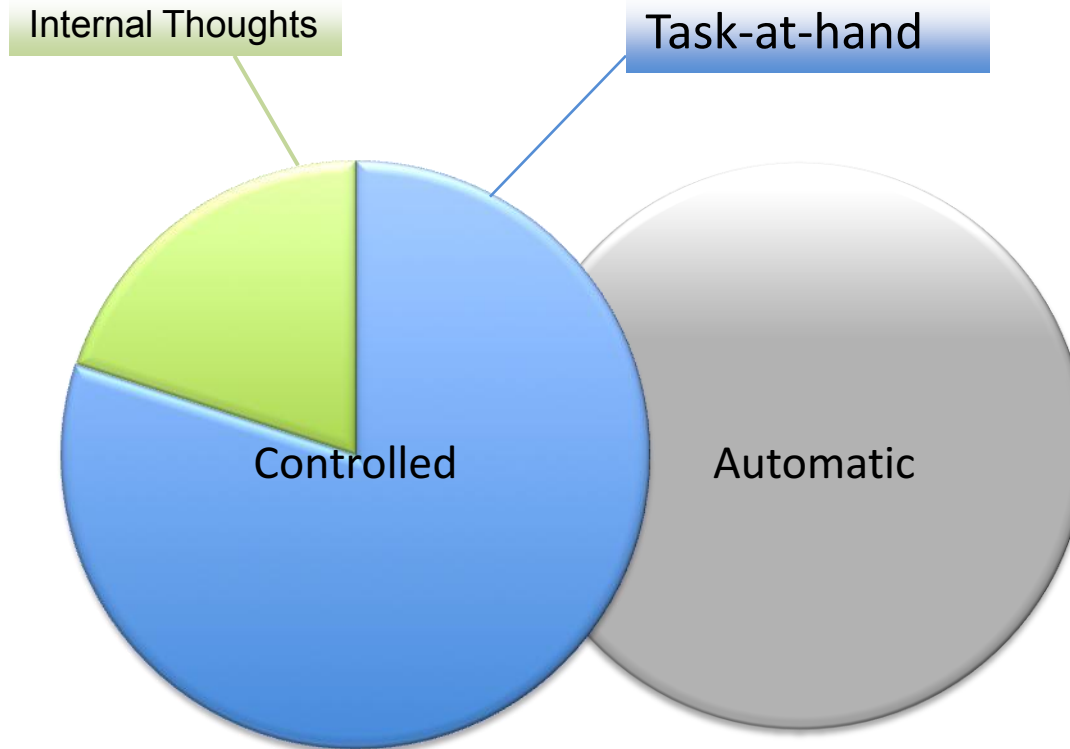
Other tasks take attentional resources away

Attention: Overload



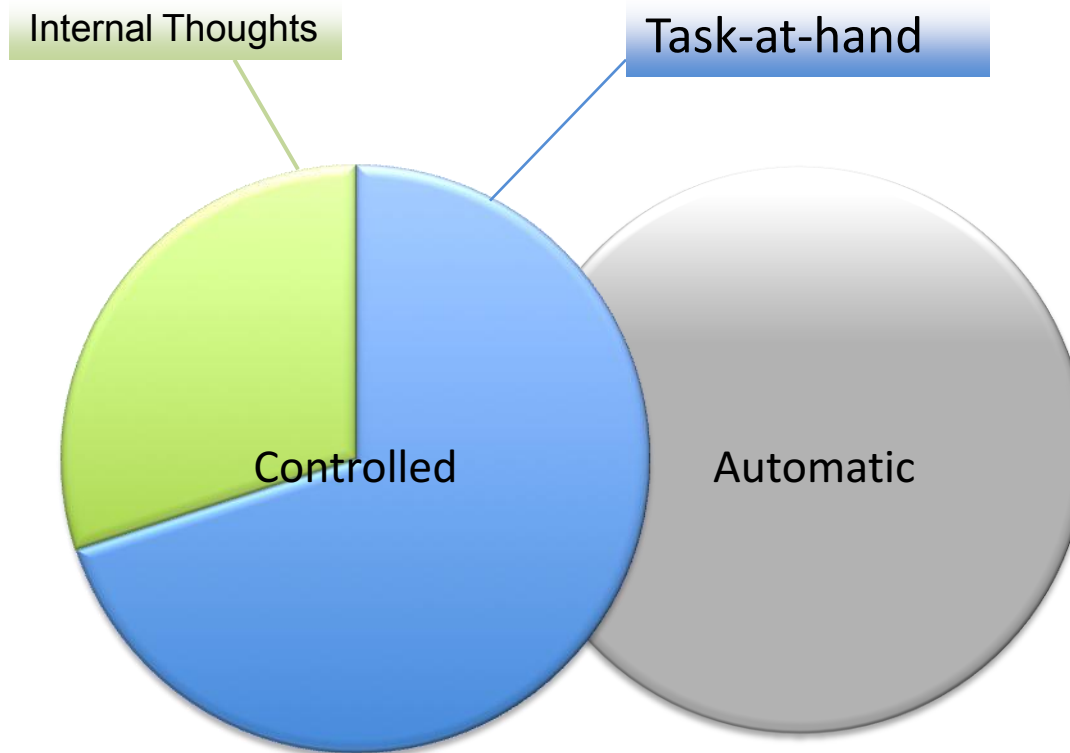
Solution: Reduce the number of other tasks

Attention & Mind Wandering



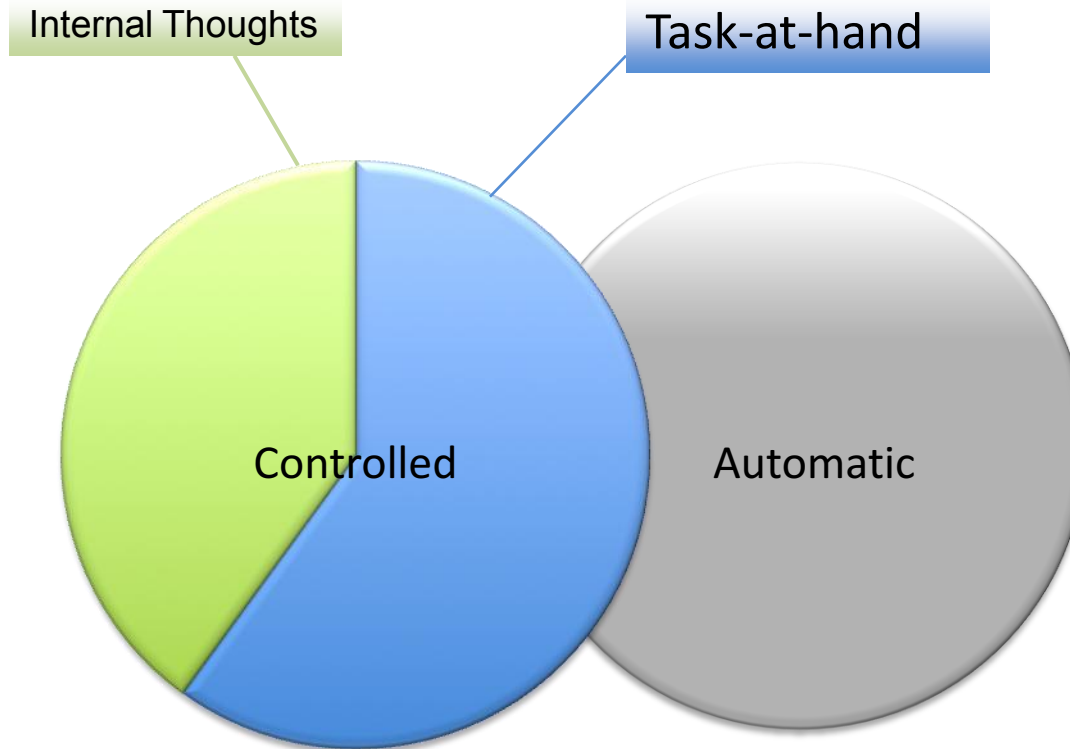
Internal thoughts also take attentional resources away

Attention & Mind Wandering



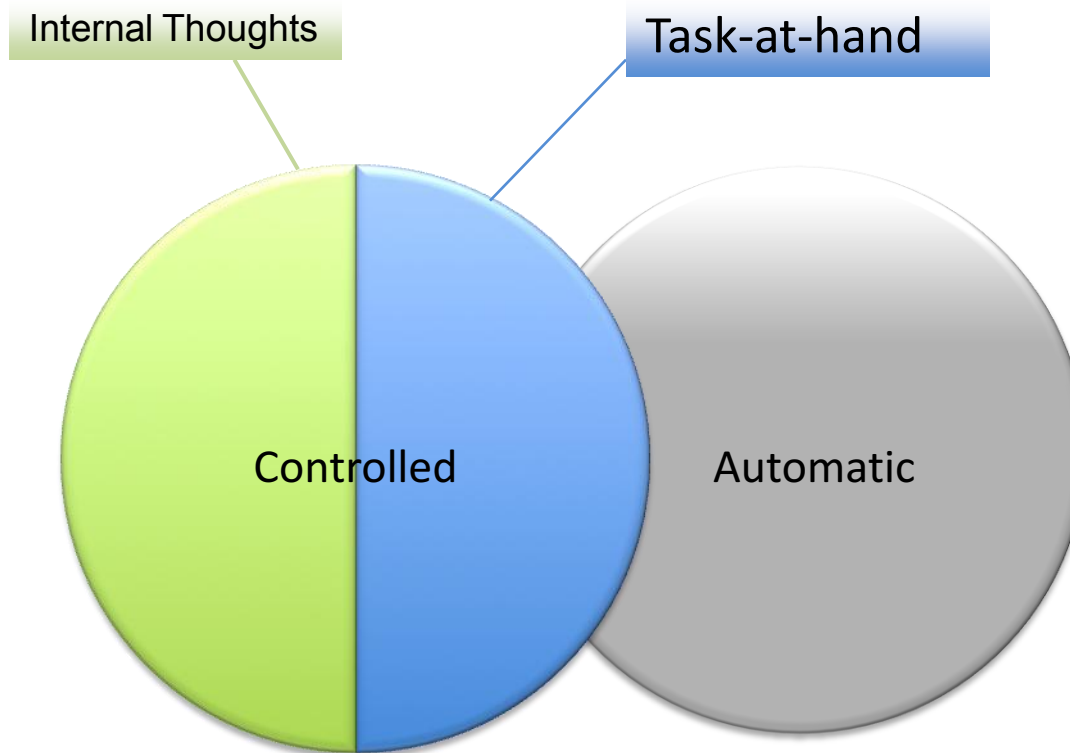
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Attention & Mind Wandering



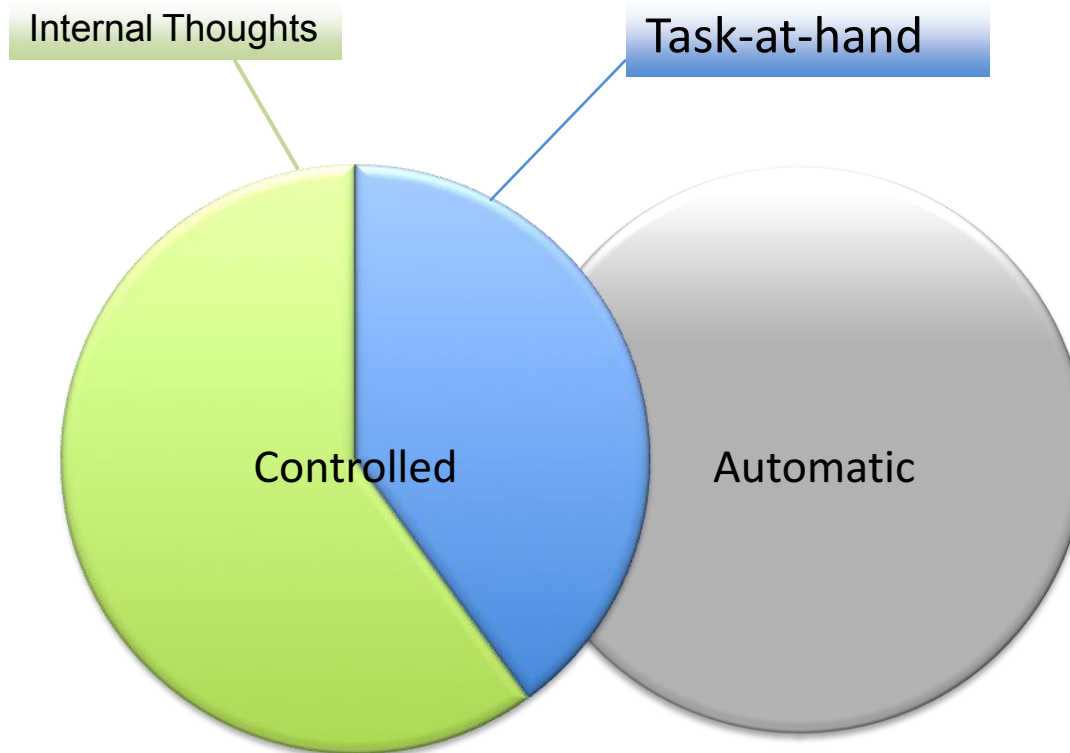
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Attention & Mind Wandering



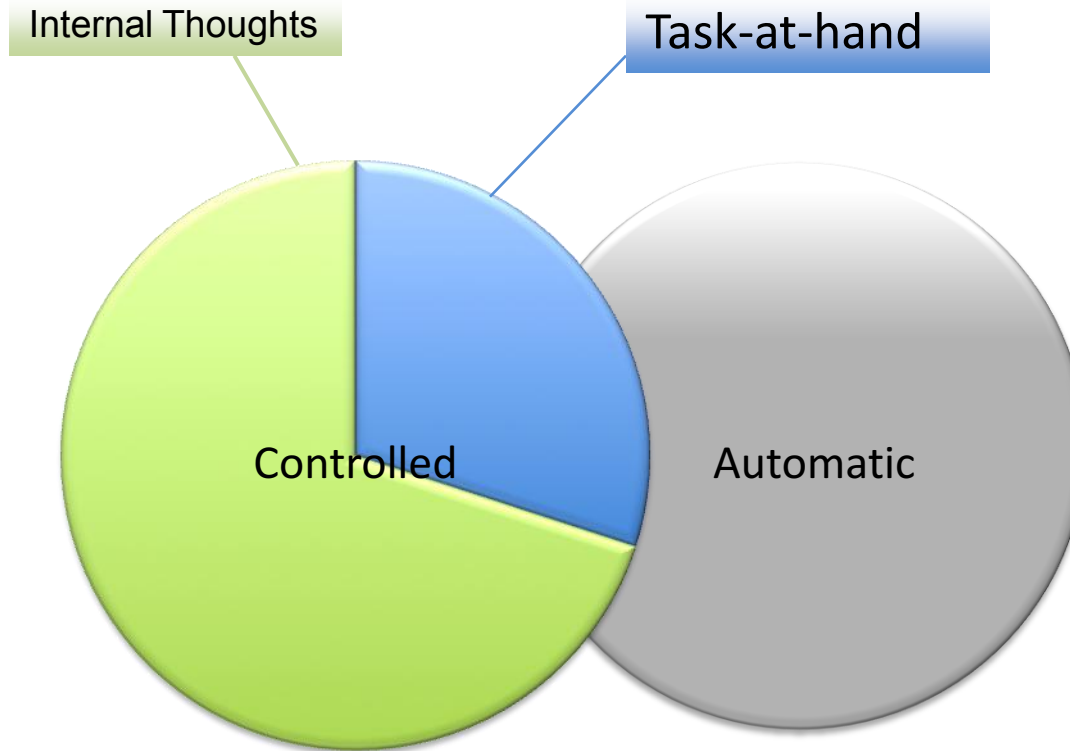
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Attention & Mind Wandering



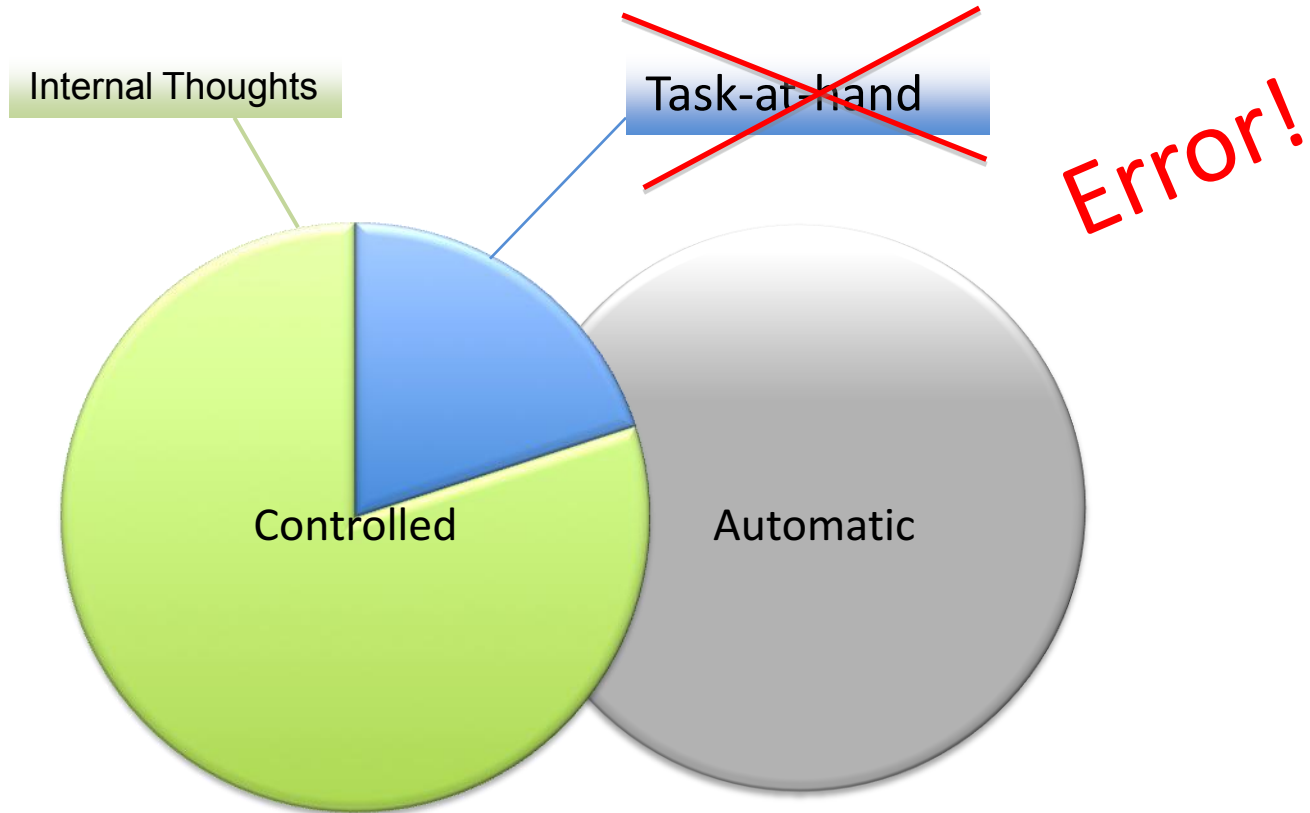
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Attention & Mind Wandering



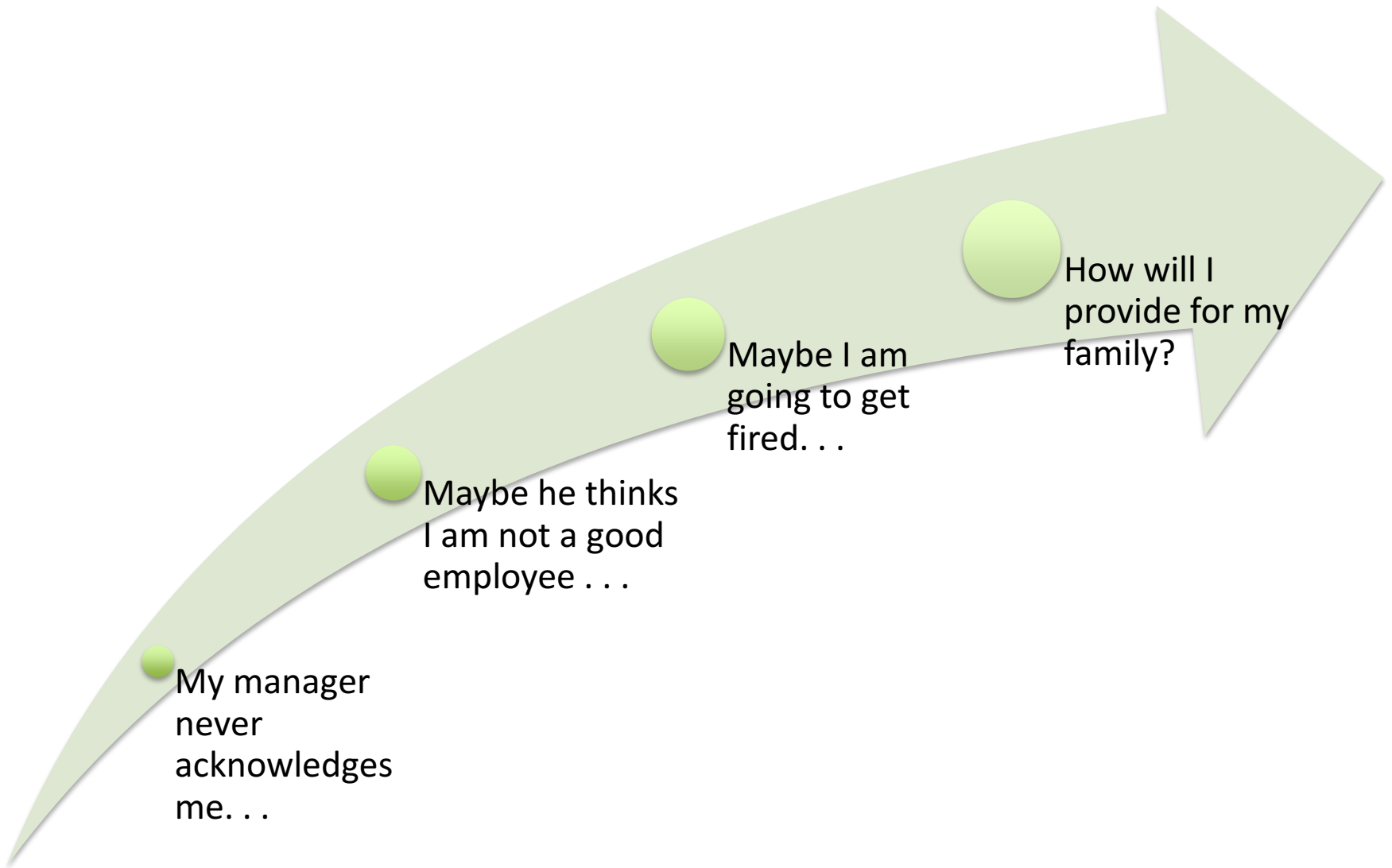
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Attention & Mind Wandering

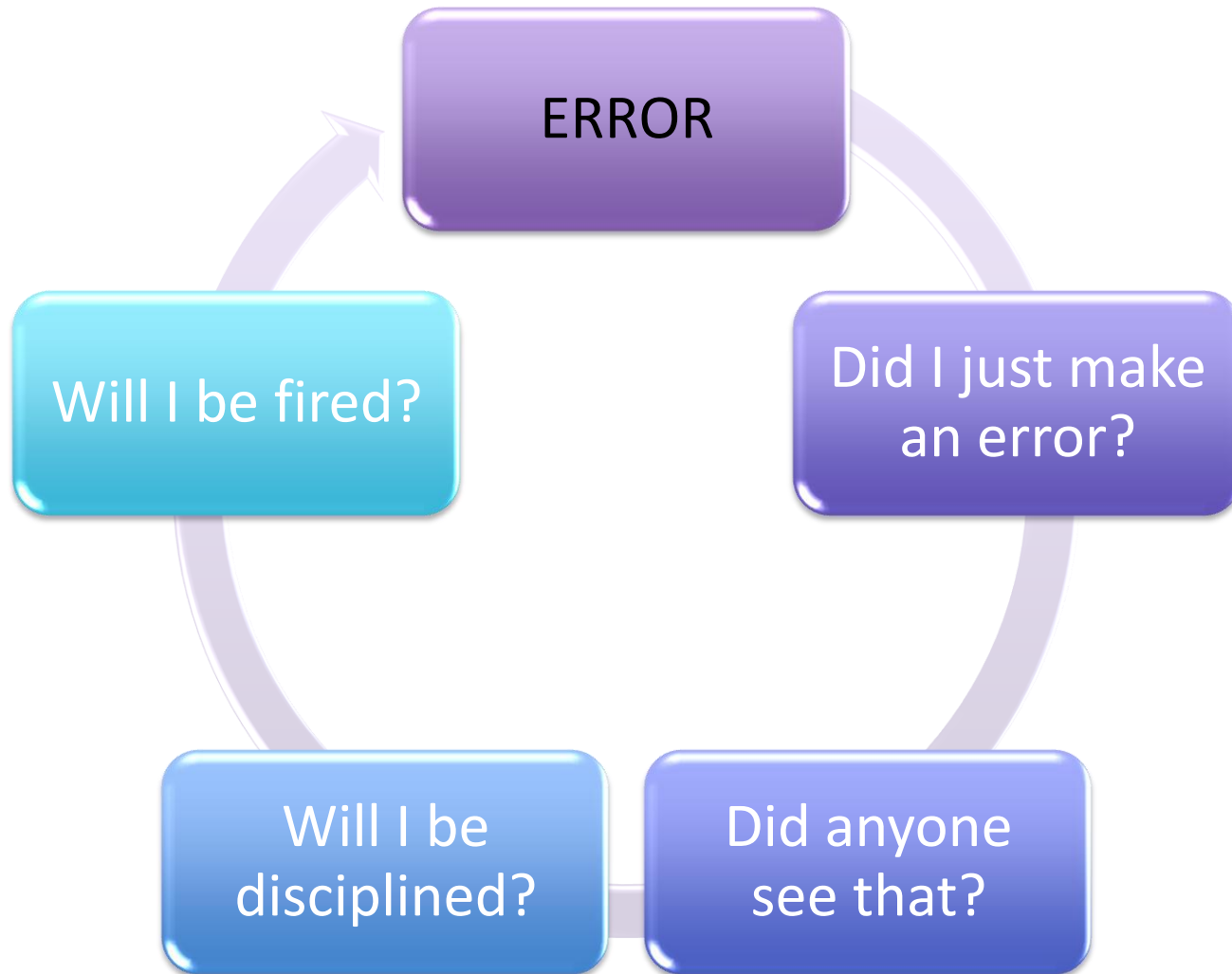


Internal thoughts also take attentional resources away

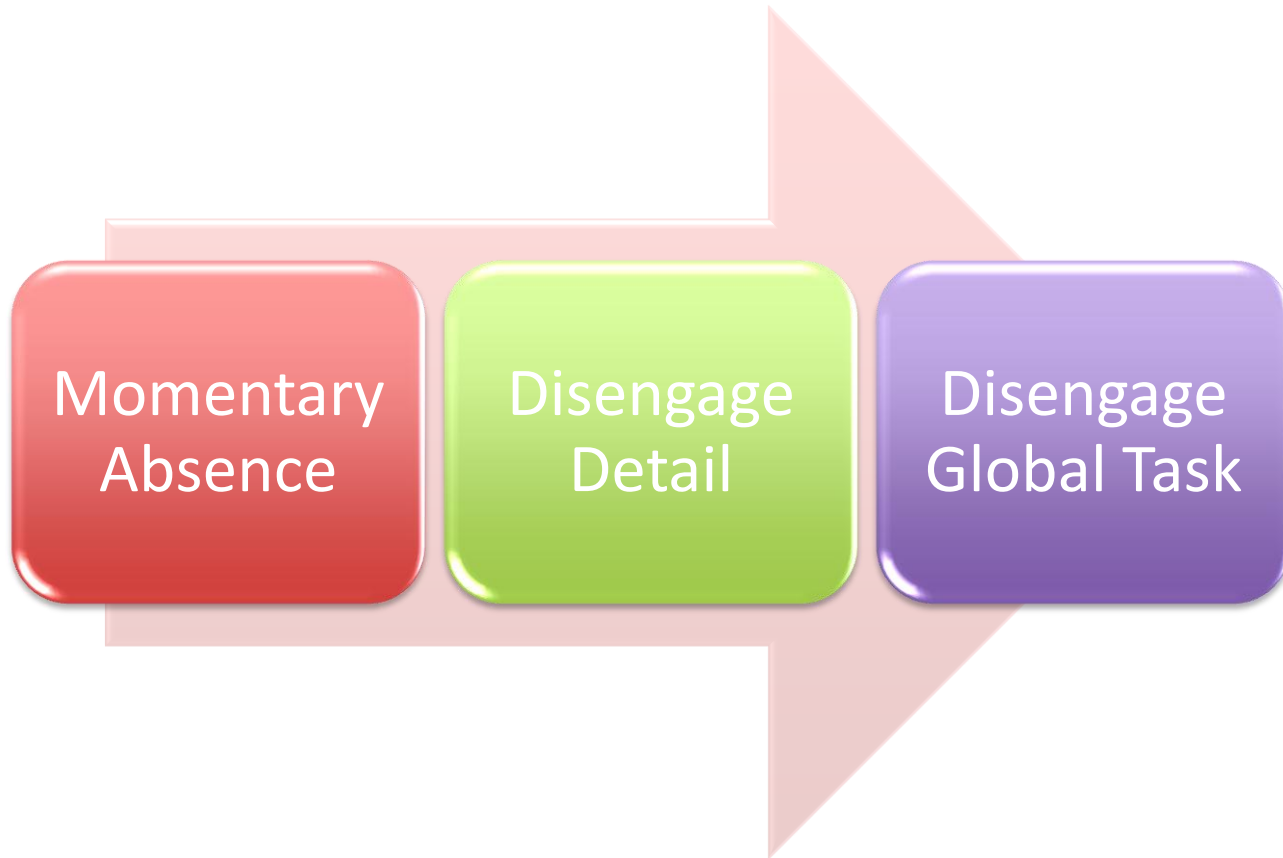
Rumination



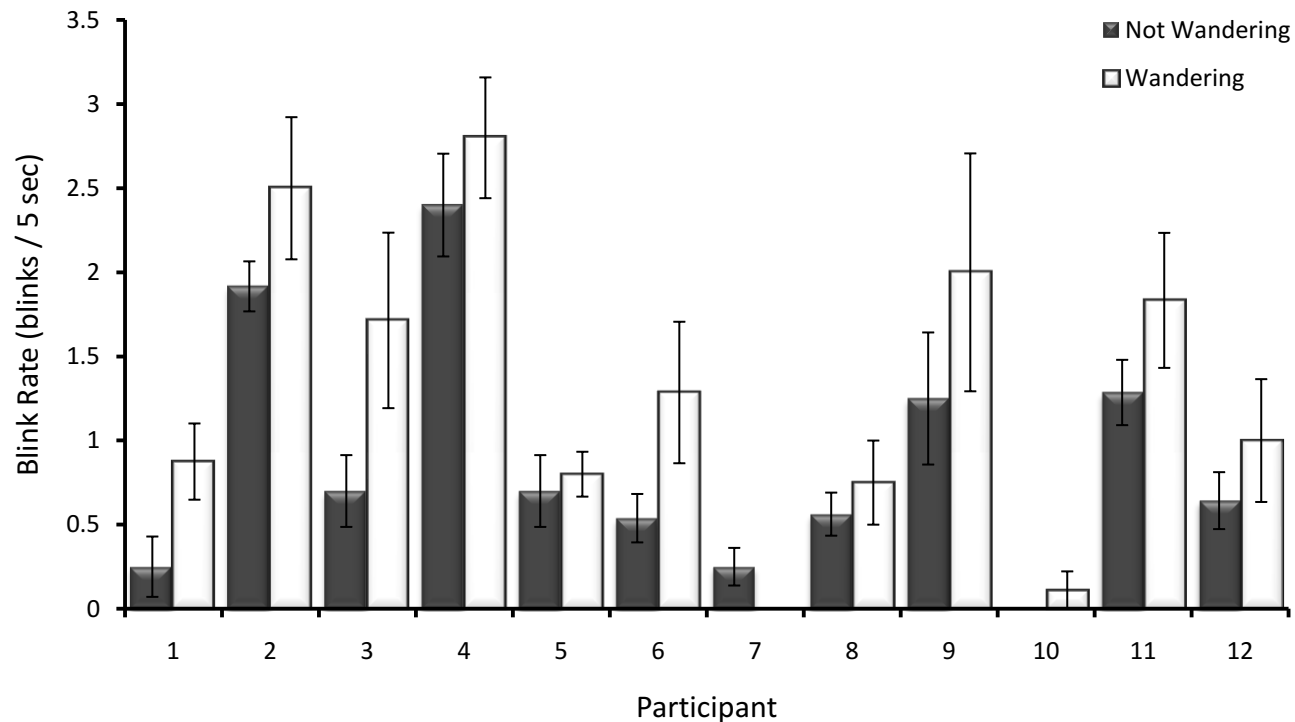
Errors Lead to More Errors



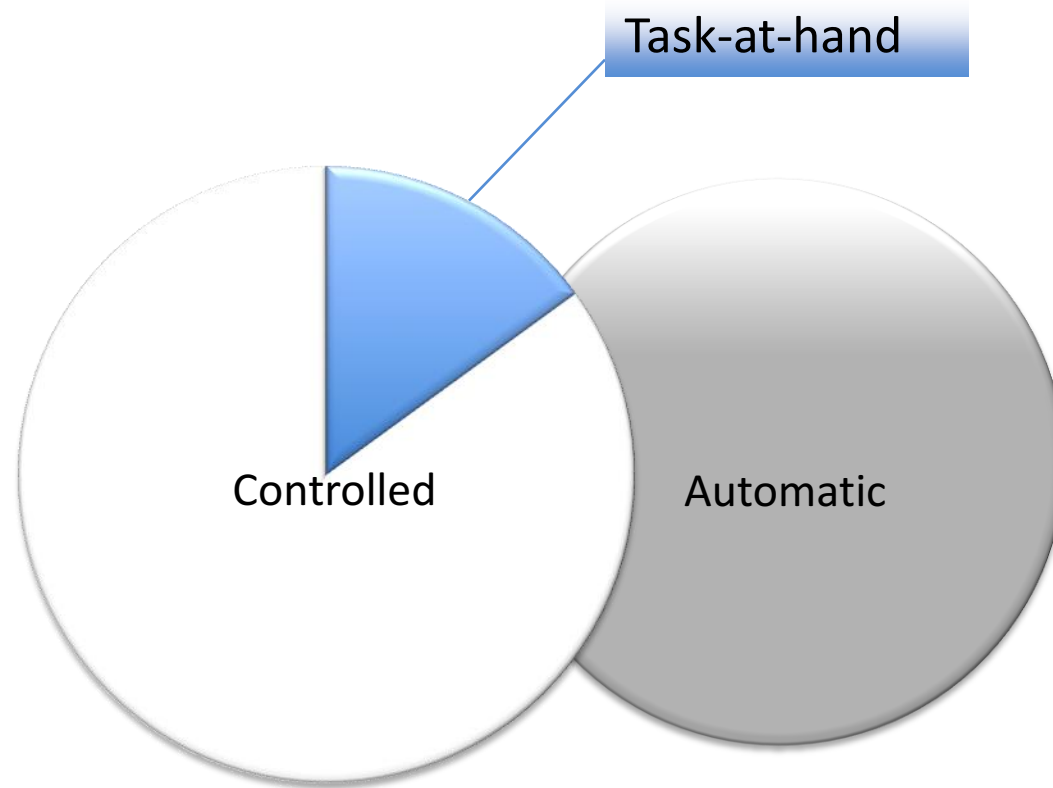
Three States of Mind Wandering



Consequences of Mind Wandering

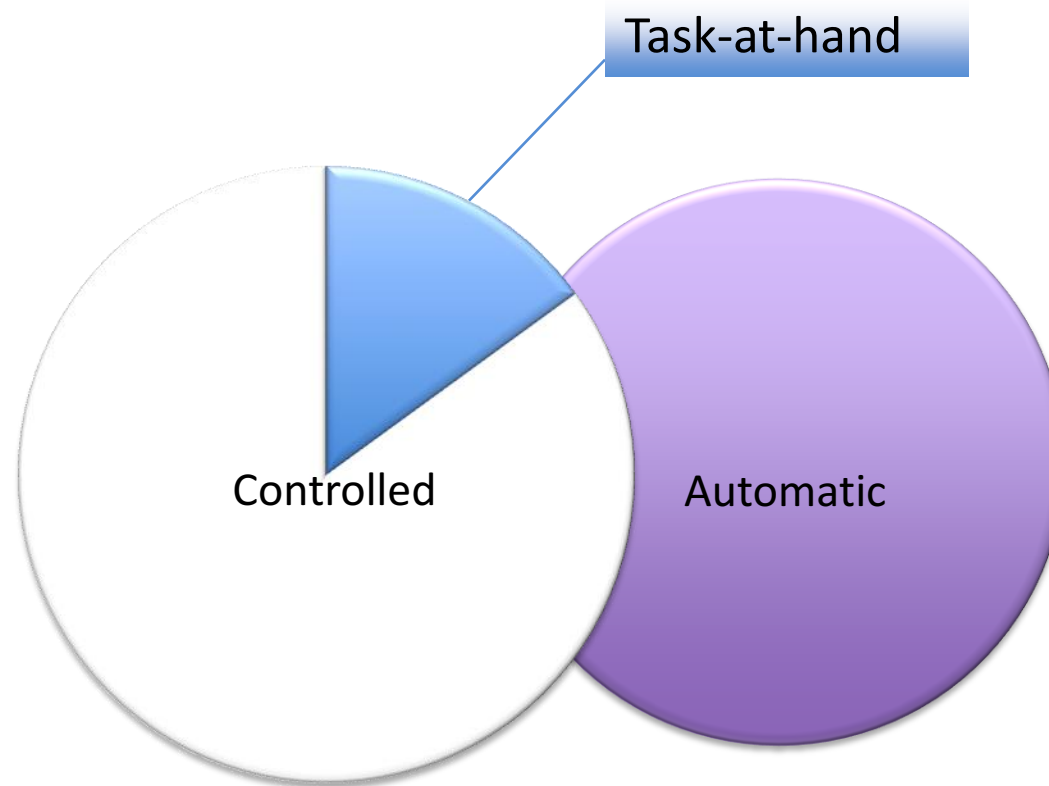


Attention: Underutilization



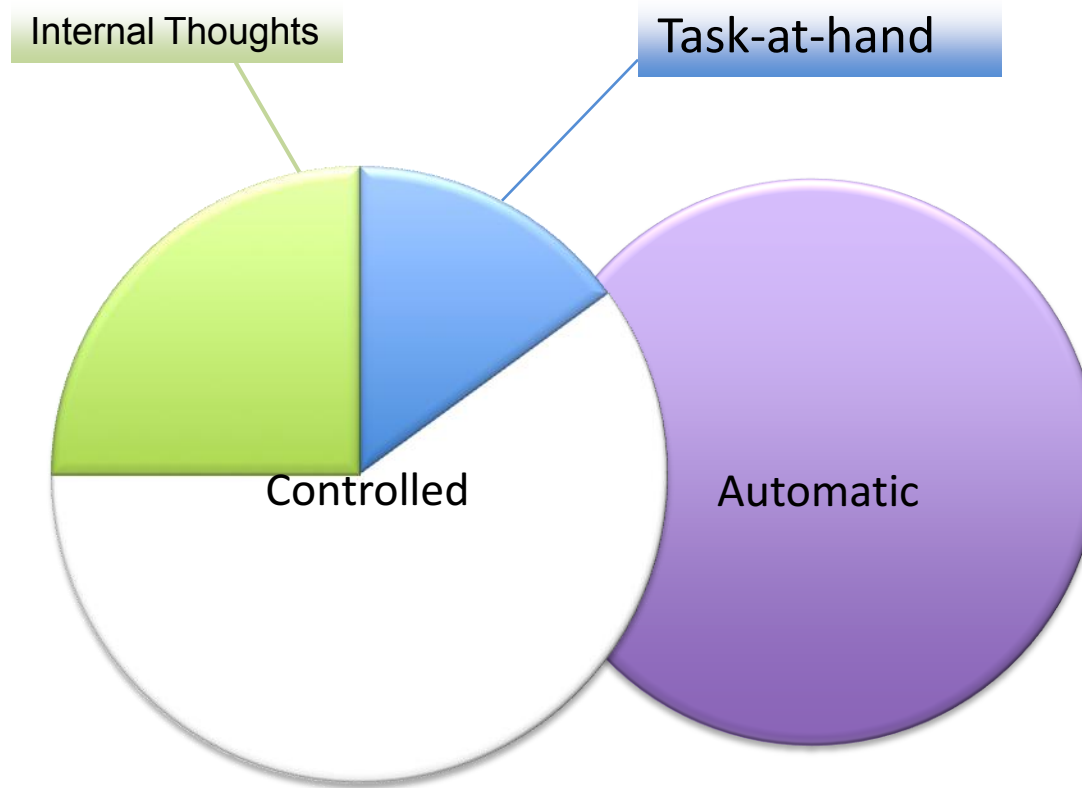
Some tasks require very few attentional resources

Attention: Underutilization



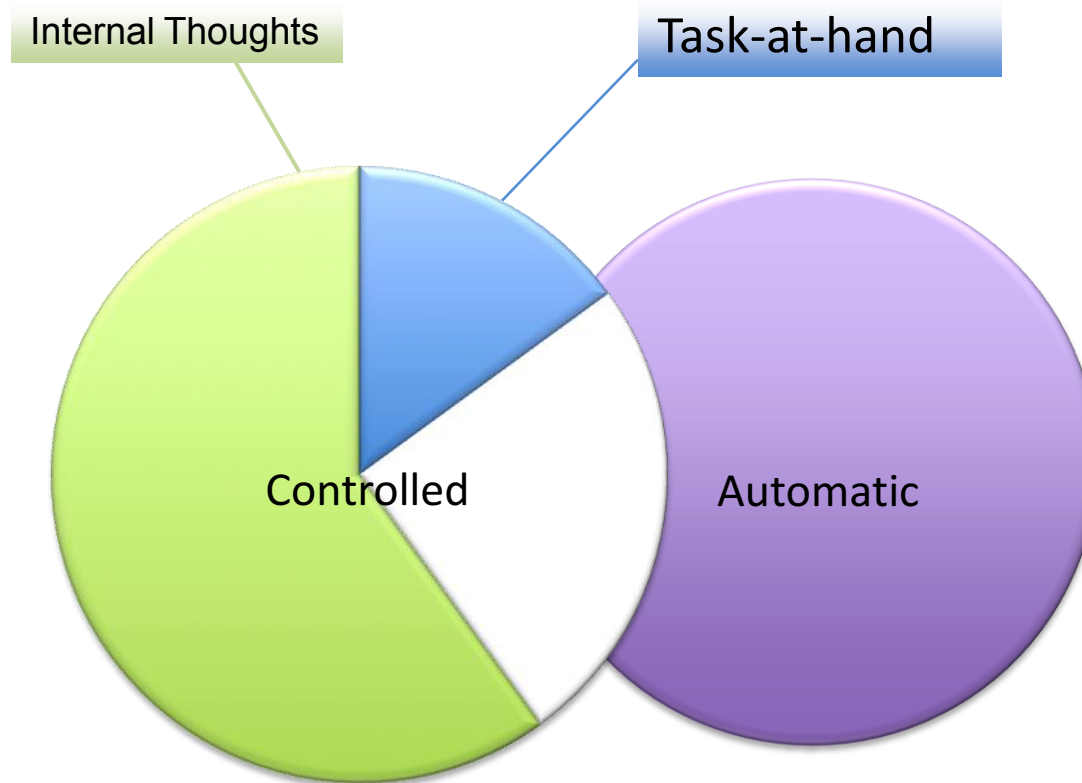
... because they can be accomplished by the automatic system

Attention: Underutilization



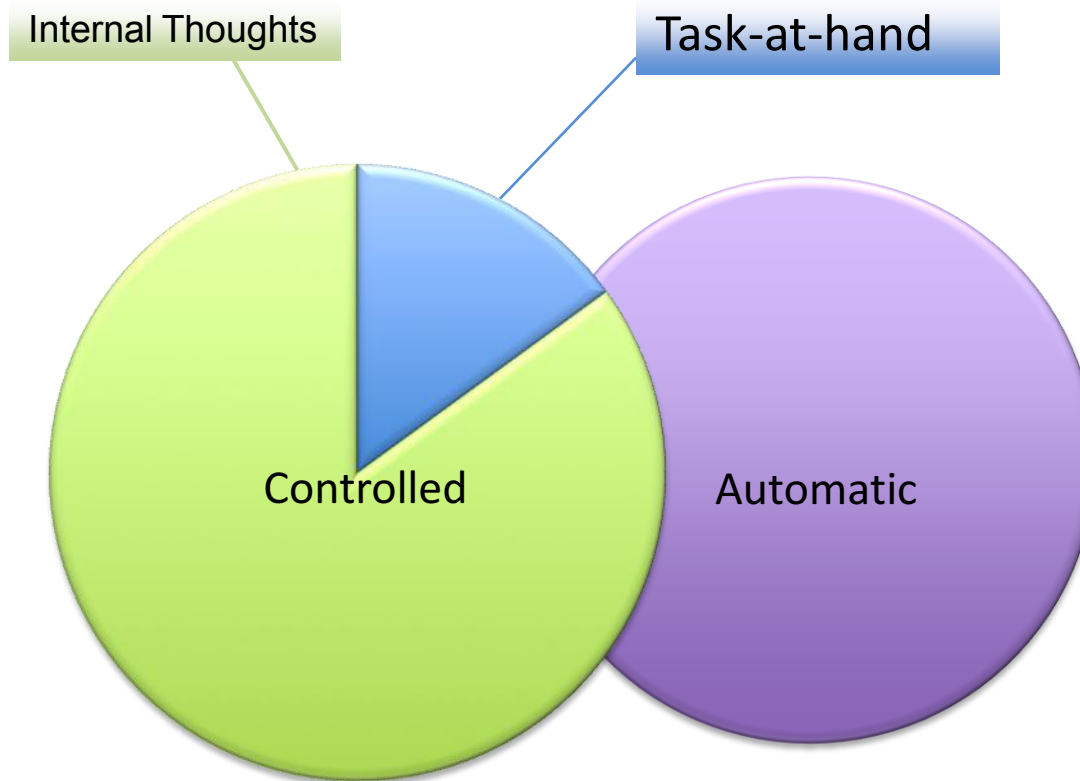
Internal thoughts will fill the void

Attention: Underutilization



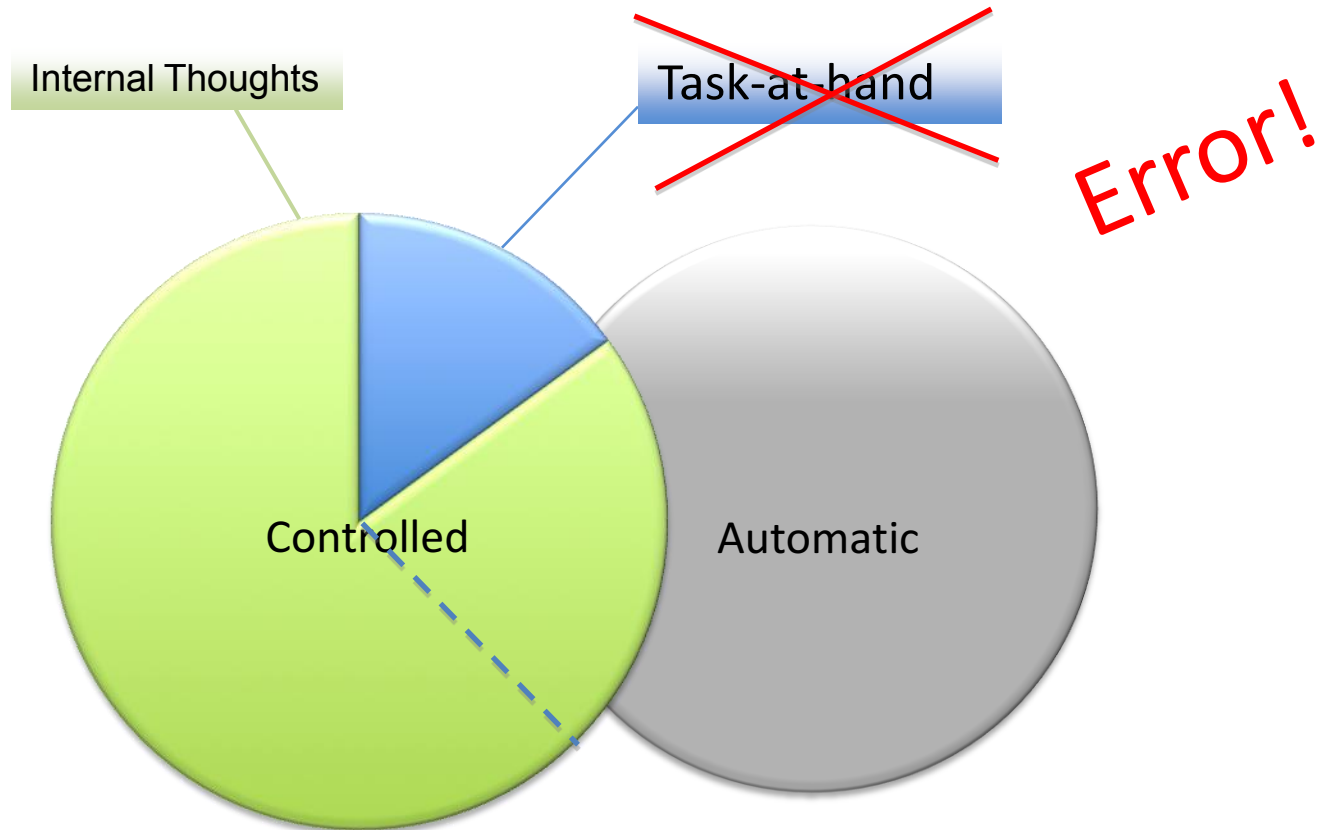
Internal thoughts will fill the void

Attention: Underutilization



Internal thoughts will fill the void




Attention: Underutilization



When more attention is needed for a task, it is not available

Workplace Attention and Awareness Survey

The WAAS

Workplace Attention and Awareness Survey

Operating Employees

4

The following questions are to be considered in the context of you being **actively engaged in your duties as an engineer or conductor** while your train is in motion under normal running conditions.

... I catch myself losing attention to the task-at-hand.

almost never	rarely	sometimes	often	very often
1	2	3	4	5

... I do my duties automatically without thinking about them.

almost never	rarely	sometimes	often	very often
1	2	3	4	5

... I find I have to exert effort to keep my attention focused on the immediate task-at-hand.

almost never	rarely	sometimes	often	very often
1	2	3	4	5

... I find that I make errors when I am thinking about something other than the immediate task-at-hand.

almost never	rarely	sometimes	often	very often
1	2	3	4	5

... I momentarily forget operating authority related items such as what signal I just had, Form B's etc.

almost never	rarely	sometimes	often	very often
1	2	3	4	5

... I have to go back and check whether I did a task correctly.

almost never	rarely	sometimes	often	very often
1	2	3	4	5

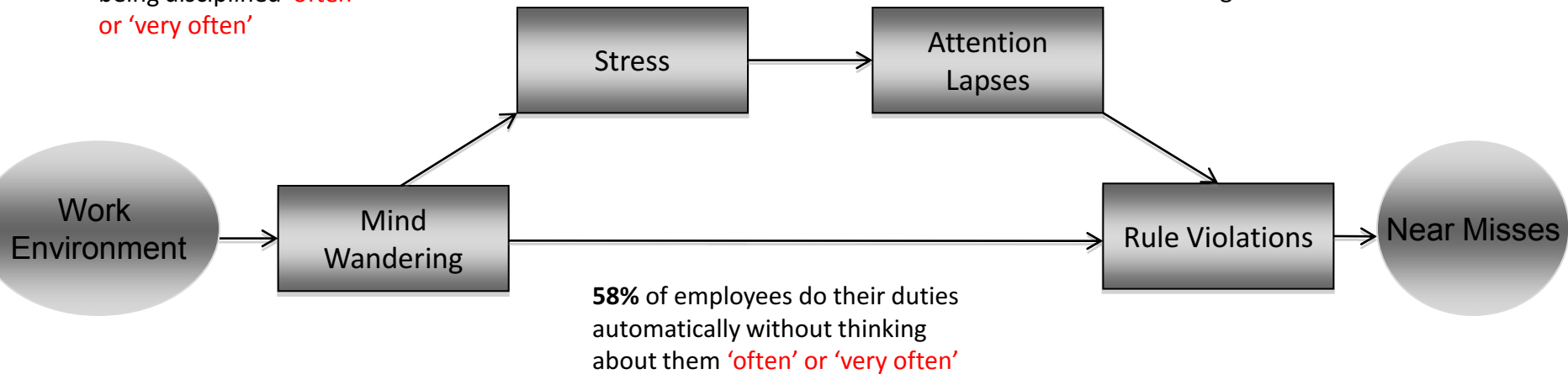
... I loose track of where I am, what I've just done or what I am supposed to be doing at any given moment.

almost never	rarely	sometimes	often	very often
1	2	3	4	5

WAAS Causal Model

71% of employees think about being disciplined 'often' or 'very often'

46% of employees reported having near misses 'sometimes'



A Step Change in Safety Performance

A New Perspective on Employee Responsibility

- The science of attention may explain why some accidents happen...

A Step Change in Safety Performance

A New Perspective on Employee Responsibility

- The science of attention may explain why some accidents happen... *but it's not an excuse!*

Employees:

- are responsible for their behavior
- are personally accountable to be attentive
- must have highly developed attention skills
- must maintain attentional competency

A Step Change in Safety Performance

A Paradigm Shift for Leaders and Managers

- Workplace Distractions:
 - operational changes, stress, organizational culture, labor/management relations, external influences
- Personal Distractions:
 - Family, financial, health, etc.
- Overload:
 - multitasking beyond capacity, job requirements, work schedules

A Step Change in Safety Performance

A Paradigm Shift for Management *(con't)*

- Underutilization:
 - mind wandering/attention lapses
- Routine & Repetitious:
 - “auto pilot” response regardless of current circumstances

Opportunities

- Cognitive sciences are evolving
- Attention skills can be learned
- New considerations for how we lead & manage
- Evolve investigation and root cause analysis
- A new strategic approach to better manage risk and exposure to loss

A Path Forward

- On-going Awareness / Education
- Competency Based Attention Training
- Future Research & Development
 - locomotive simulator analysis
 - cognitive analysis of accident & injury data
 - workplace attention & awareness surveys
 - cognitive interface with new technology (PTC)