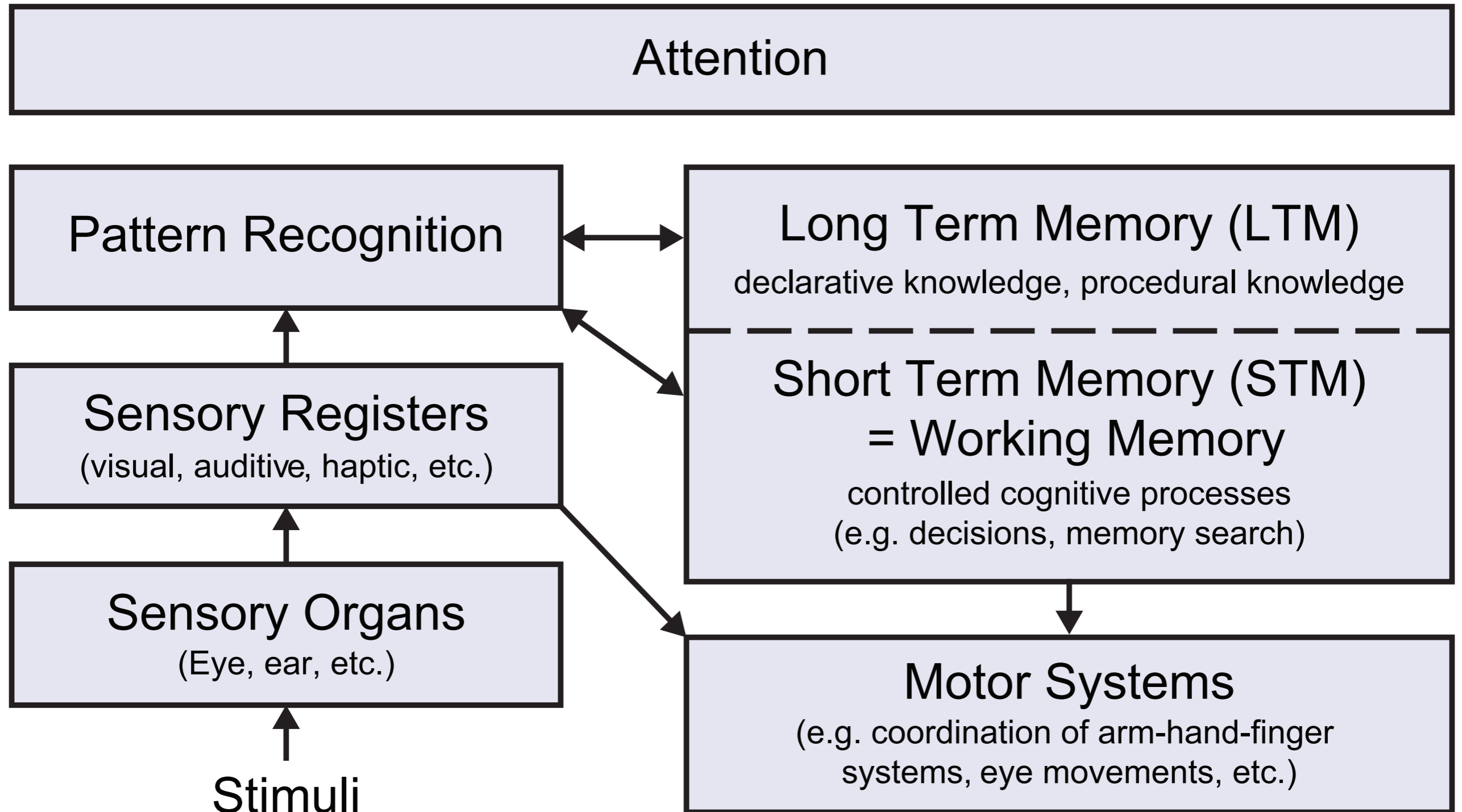


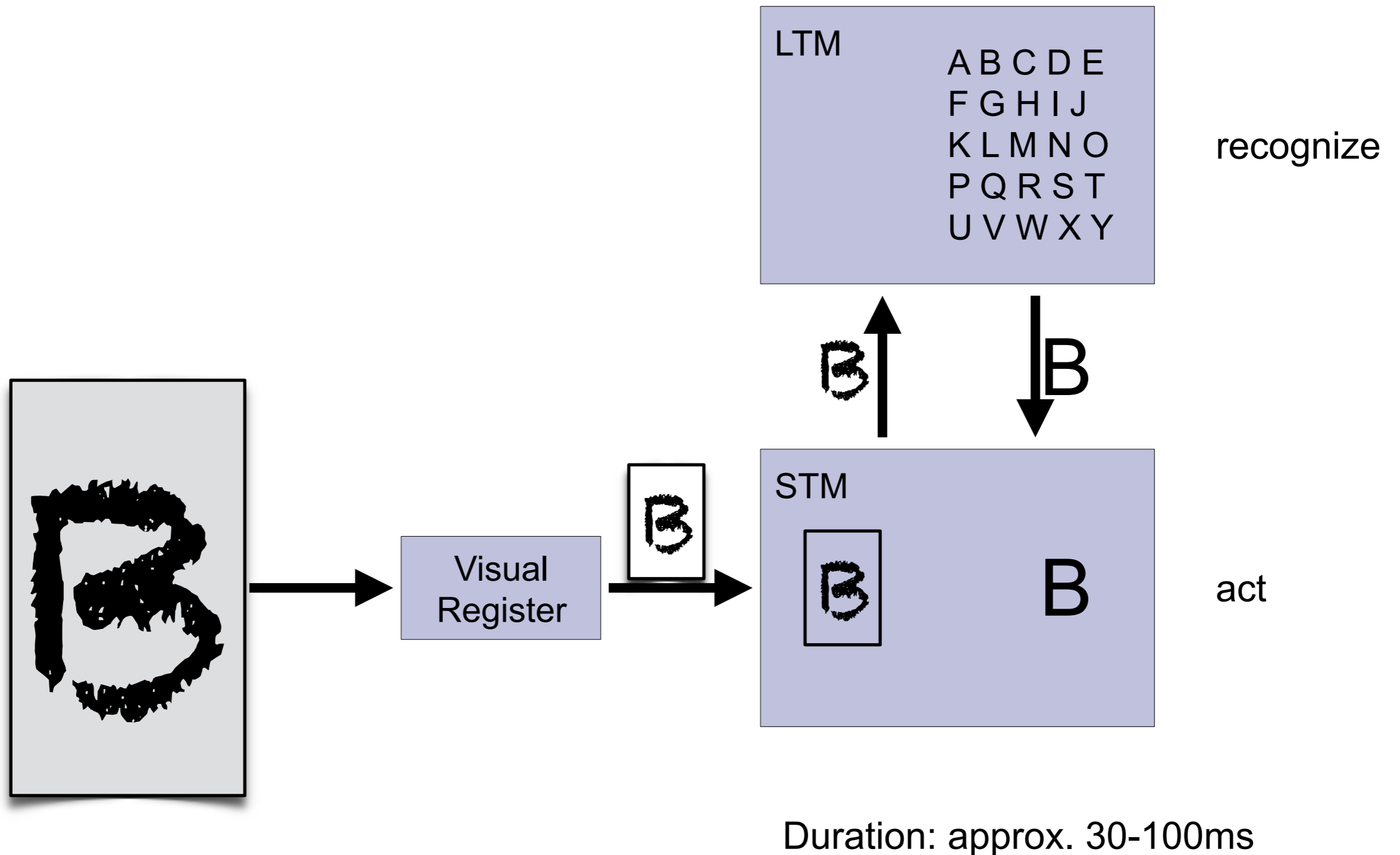
Chapter 3 - Cognition

- Types of human memory
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 - Working memory load
 - Multitasking
 - Measurement of cognitive load
- Decision making and time

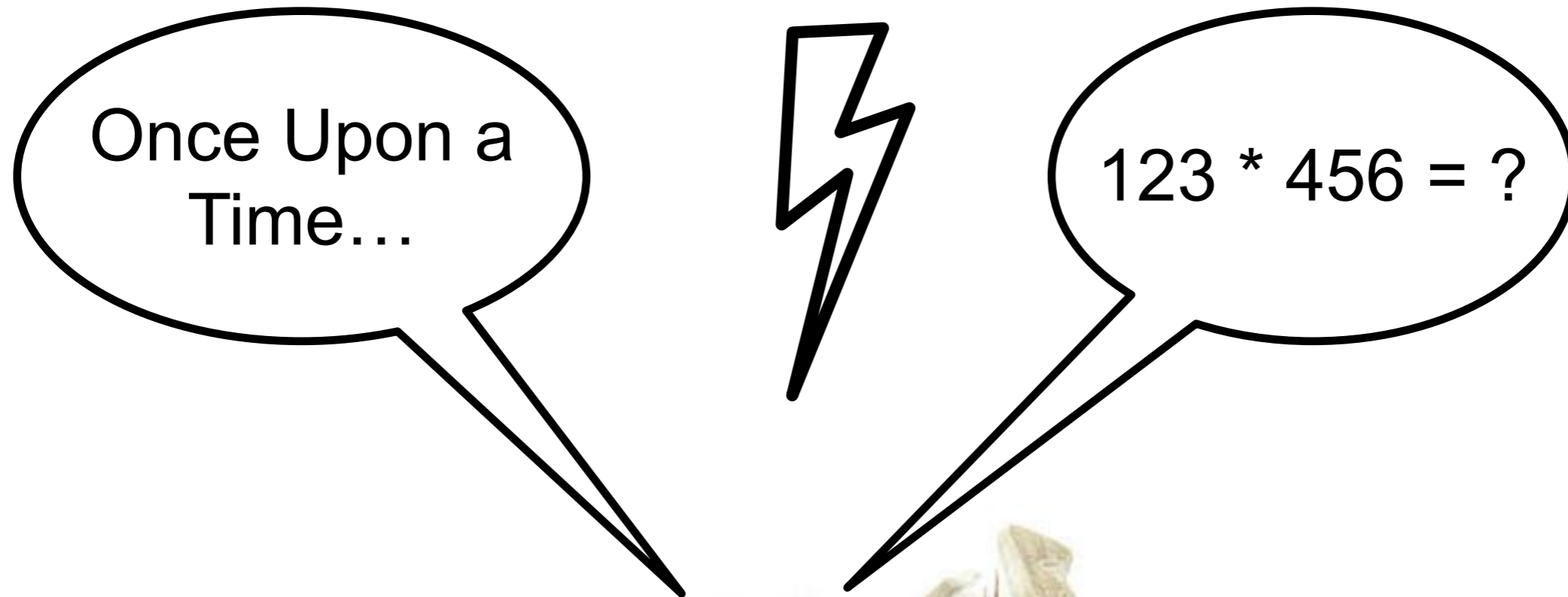
Recap: Basic Model



Short Term Memory: *Recognize-Act Cycle*



Limitations of Short Term Memory



<http://autoimg.frauenzimmer.de/autoimg/457508/300x600/sie-lesen-geme-dann-sind-sie-bei-frauenzimmer-de-genau-richtig.jpg>

Source:
<http://autoimg.frauenzimmer.de/>

Chunks in Short Term Memory

- Capacity (in general): approx. 3 (2 to 4) chunks
 - for very short durations (2s) up to 7 (5 to 9) chunks

01000010	=	42	=	B
Binary		Hex		ASCII

Dot



Dash



S



O

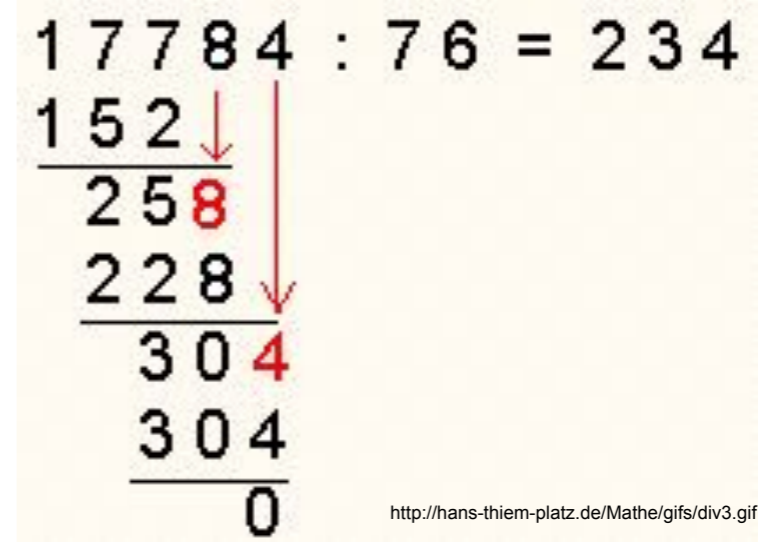
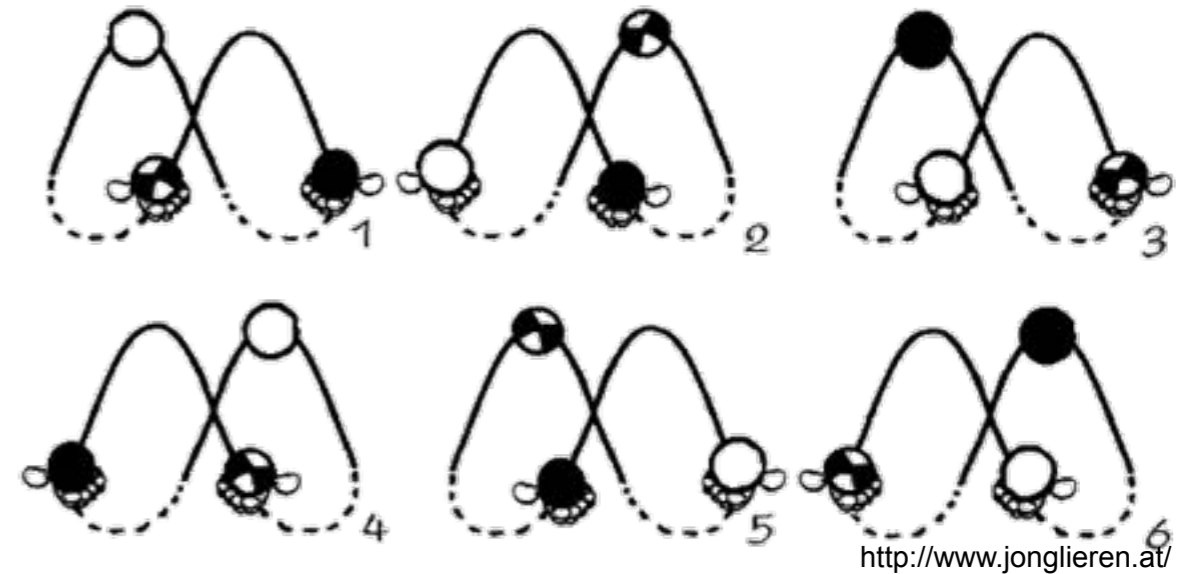
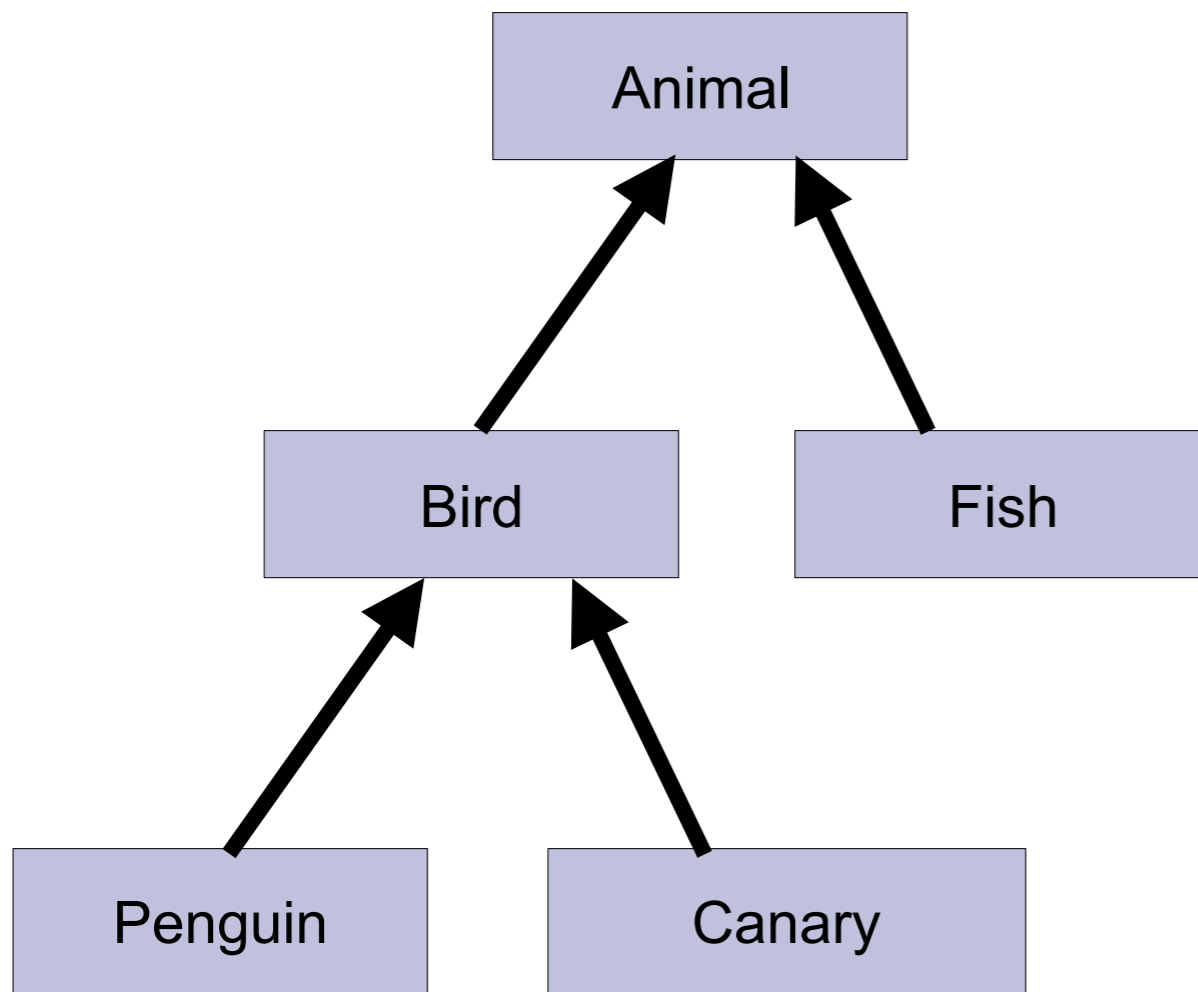


SOS



Long Term Memory

- Declarative knowledge
- Procedural knowledge
 - motor knowledge vs. cognitive knowledge



Recognition vs. Recall

- Of what brand is your bike?
 - Answer has to be produced
 - Example: `grep "recall" chapter??.tex`
- Is your bike of brand XYZ?
 - Yes/no decision only



<http://www.graphicsfuel.com/wp-content/uploads/2013/03/20-social-media-icons.png>



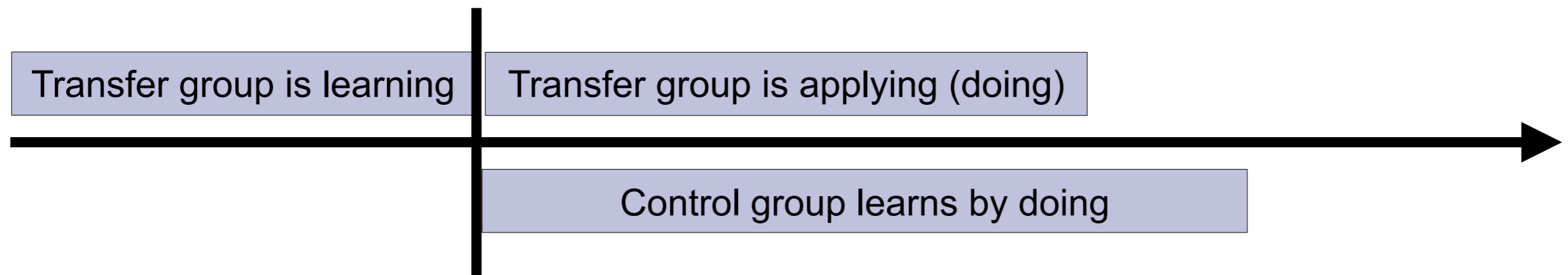
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Evaluation of Learning Methods

- Control group: learns without method (trial & error)
- Transfer group: learns with new method (e.g. course)
- Measuring the *time* until a certain *achievement* is reached



$$\text{TransferPerformance} = \frac{\text{Time}_{\text{controlGroup}} - \text{Time}_{\text{transferGroup}}}{\text{Time}_{\text{controlGroup}}} * 100$$

$$\text{TransferEfficiency} = \frac{\text{Time}_{\text{controlGroup}} - \text{Time}_{\text{transferGroup}}}{\text{Time}_{\text{newMethod}}} * 100$$

$$\text{TrainingCostRatio} = \frac{\text{Training cost of new method (per time unit)}}{\text{Training cost of old method (per time unit)}}$$

Learning by Examples

- Instructables
- YouTube
- Tutorials for lecture



<http://www.instructables.com/id/SnickerPoodles/?ALLSTEPS>

Practical Exercise (Learning by Doing)



Training of Sub-Tasks

- (Steering + Balance) + Pedaling = Cycling



<https://images.otto.de/asset/mmo/formatz/kettler-spirit-air-laufrad-rot-6127942.jpg>

+



https://images.otto.de/is/image/mmo/4677310?Sov_formatg2S

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<https://images.otto.de/is/image/mmo/10444993?S001PICT01S>

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<http://de.fotolia.com/id/53617865>

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<https://images.otto.de/is/image/mmo/10443623?S001PICT01S>

Chapter 3 - Cognition

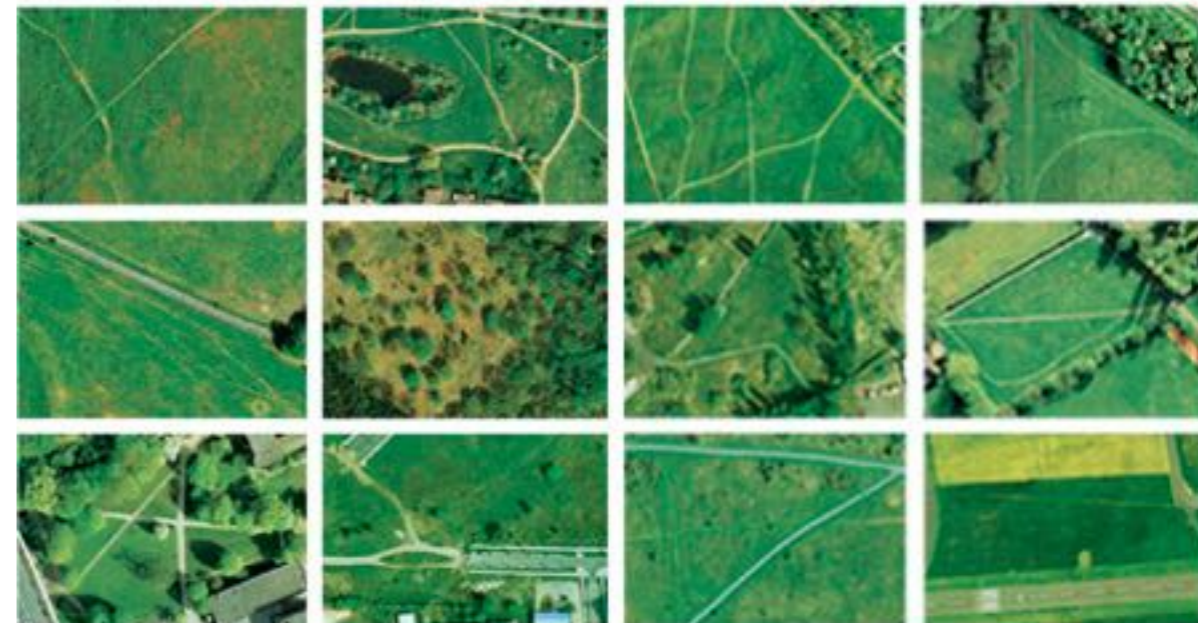
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Trace Decay Theory

- Based on work by psychologist Hermann Ebbinghaus
- Experiment: Rehearsing non-sense syllables
 - Memory fades just by passage of time
 - Theory (Thorndike 1914): Memory trace (access path) decays
- More recent insights:
 - Not only time is relevant but also knowledge *activation*
 - When and how often the knowledge was accessed?
- Rarely used knowledge fades over time



<http://www.dreamon.at/wp-content/themes/ut-gogreen/img/slider/spuren-im-sand.jpg>



<http://sz-magazin.sueddeutsche.de/upl/images/user/252434/27452.jpg>

Interference Theory

- New knowledge replaces old knowledge
- Example: Moving house, street names
- Example: Changing school, names of other pupils
- Example: Unused foreign language
- other examples??



Factors Slowing Down the Forgetting Process

- Strong emotions:
 - Associated knowledge is kept longer in memory
- Context:
 - Learning and recall within the same context (e.g. room)



http://www.abu-dhabi.diplo.de/contentblob/1981068/Galeriebild_gross/205940/maedchen_lernen.jpg

<http://www.stressfrei-zum-erfolg.de/media/images/stressfrei-zum-erfolg-01.jpg>



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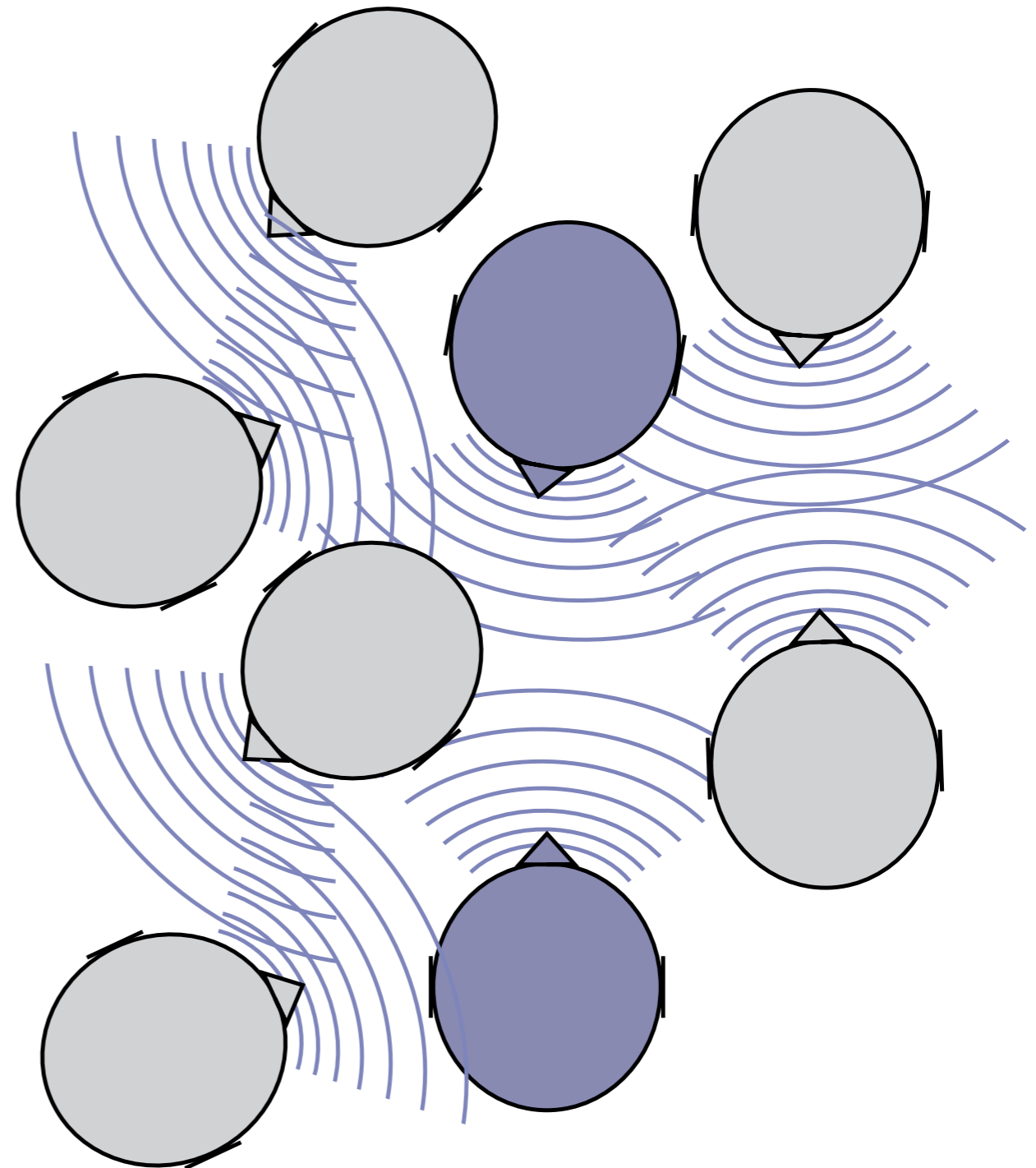
Selective Attention

<https://www.youtube.com/watch?v=mg11glsBW4Y>



Cocktail Party Effect

- Selective hearing
- Organized conversation in presence of many different voices
- Irrelevant voices attenuated by up to 15dB
 - only perceived volume
 - not physically!
- Function of the human brain, currently not realizable by technology



Focussed Attention

KEEPVID

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KEEPVID Bookmarklet

- 1.) Drag this button onto your links toolbar
- 2.) Click **Keep It!** when watching a video to download it

<http://www.youtube.com/watch?v=alwcN2VN-98>

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Shared Attention



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<http://ais.badische-zeitung.de/piece/00/3f/3b/42/4143938.jpg>



https://www.allianz.de/static-resources/ratgeber/auto/medien/v_1355996131000/ablenkung_818x460.jpg



<http://img.welt.de/img/news/crop111875297/030872660-ci3x2l-w620/Hektik-hilft-nicht.jpg>



Change Blindness



<https://www.youtube.com/watch?v=ubNF9QNEQLA>

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Working Memory Load / Cognitive Load in Learning

Extraneous Load

- created by form and design of presentation

Intrinsic Load

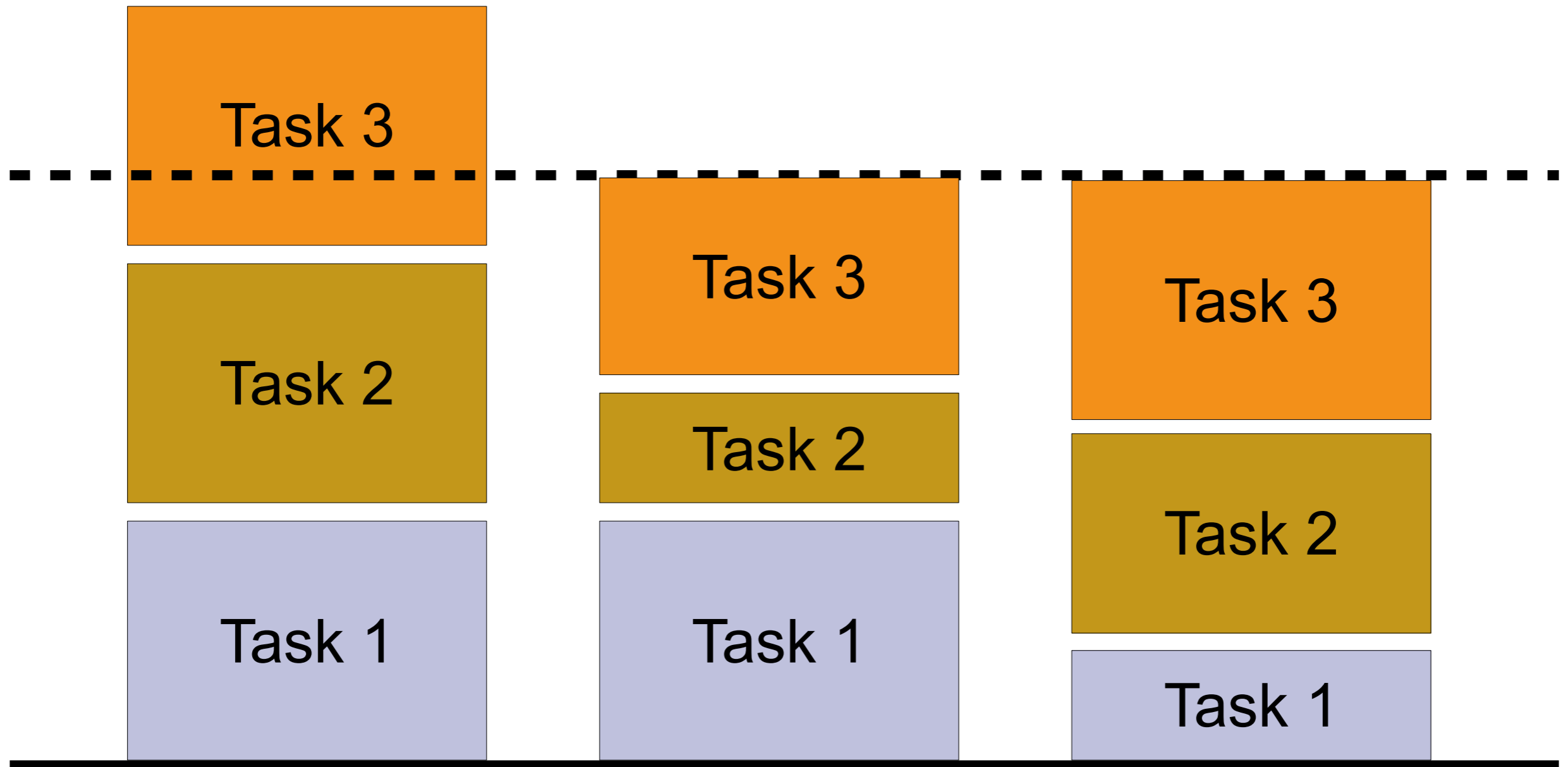
- created by the task itself

Germane Load (Learning Load)

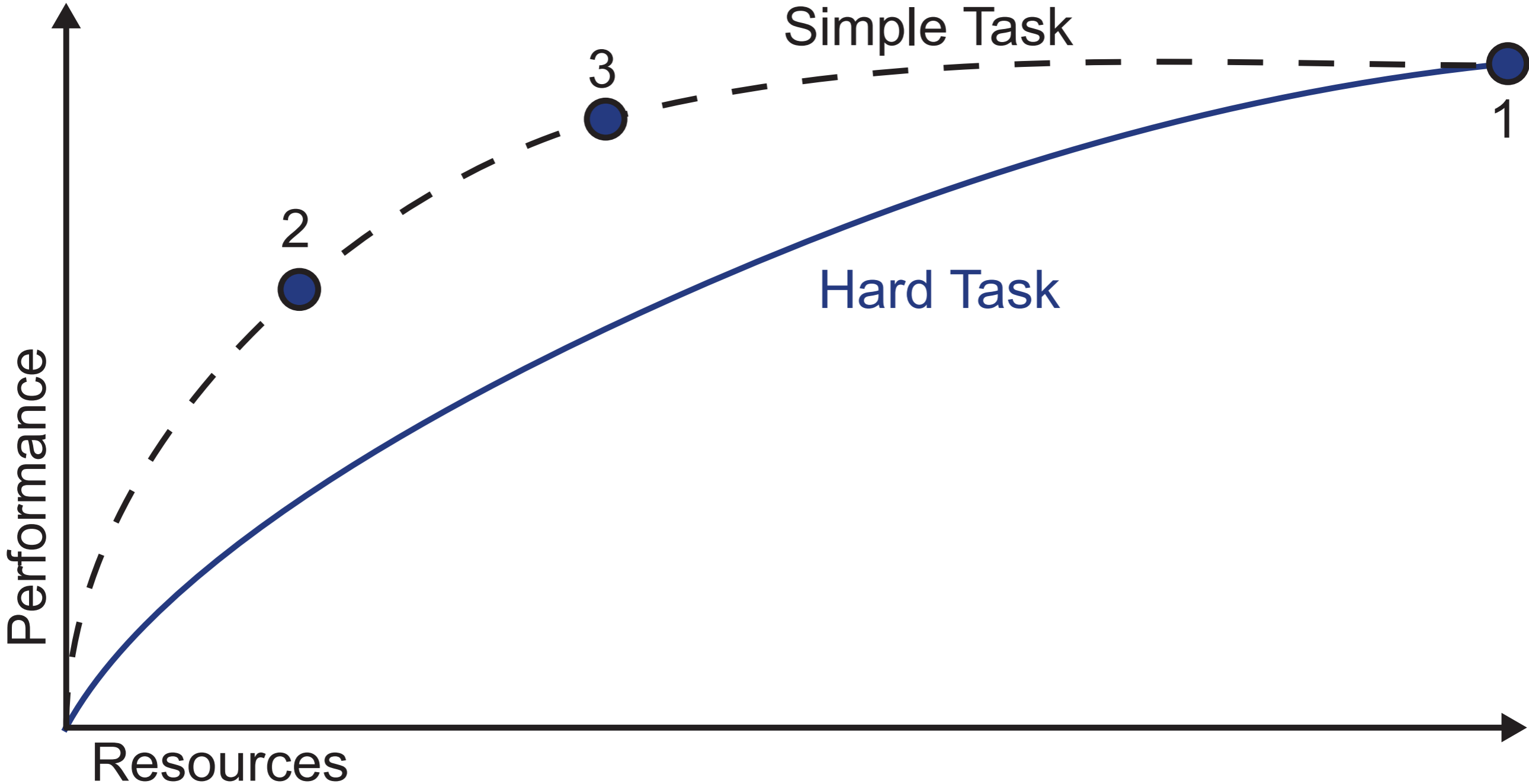
- necessary for finding and automatization of new schemata

Cognitive Load Theory (CLT)
by John Sweller and Paul Chandler

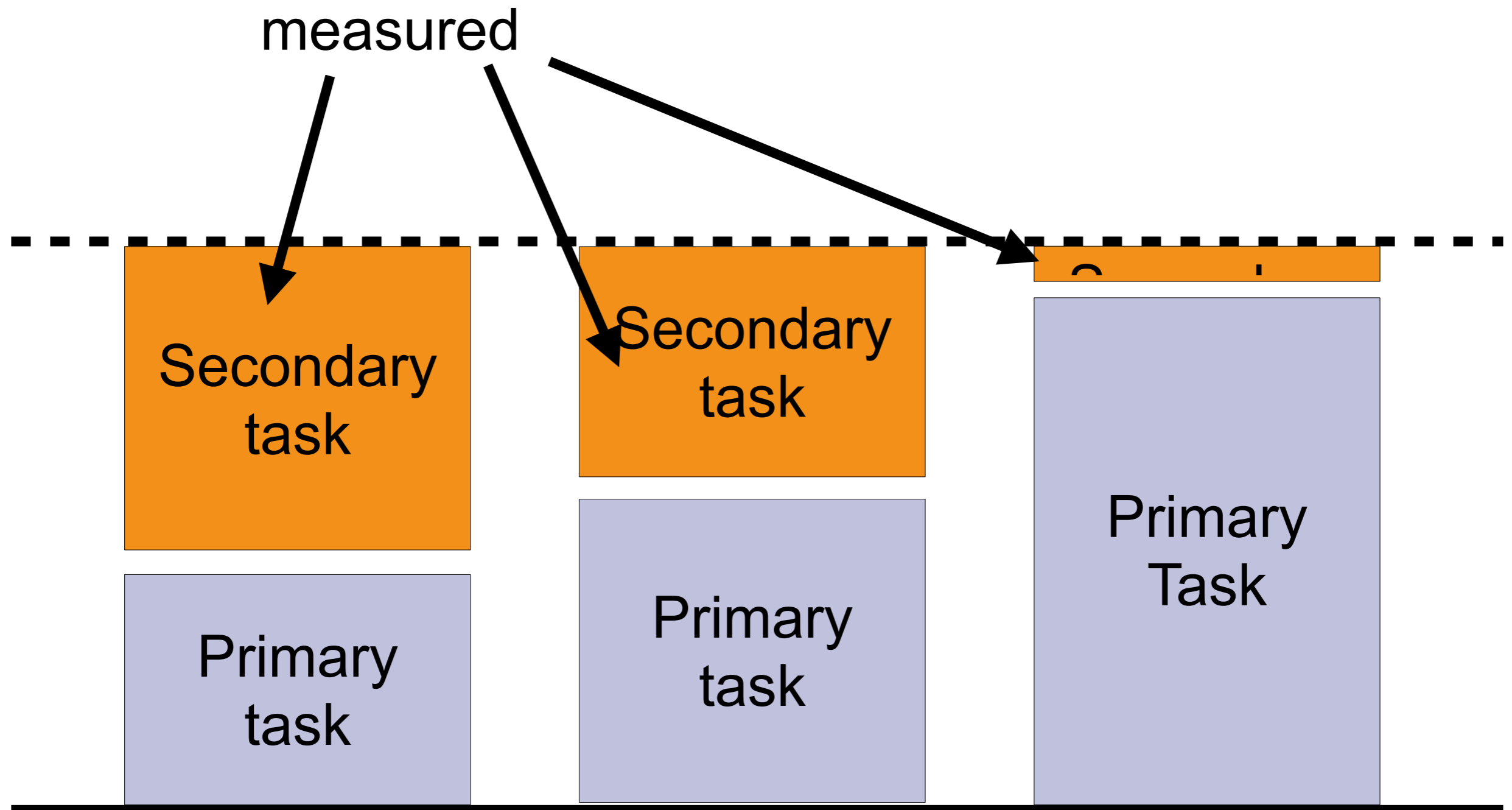
Cognitive Load in Multitasking



Performance Resource Function



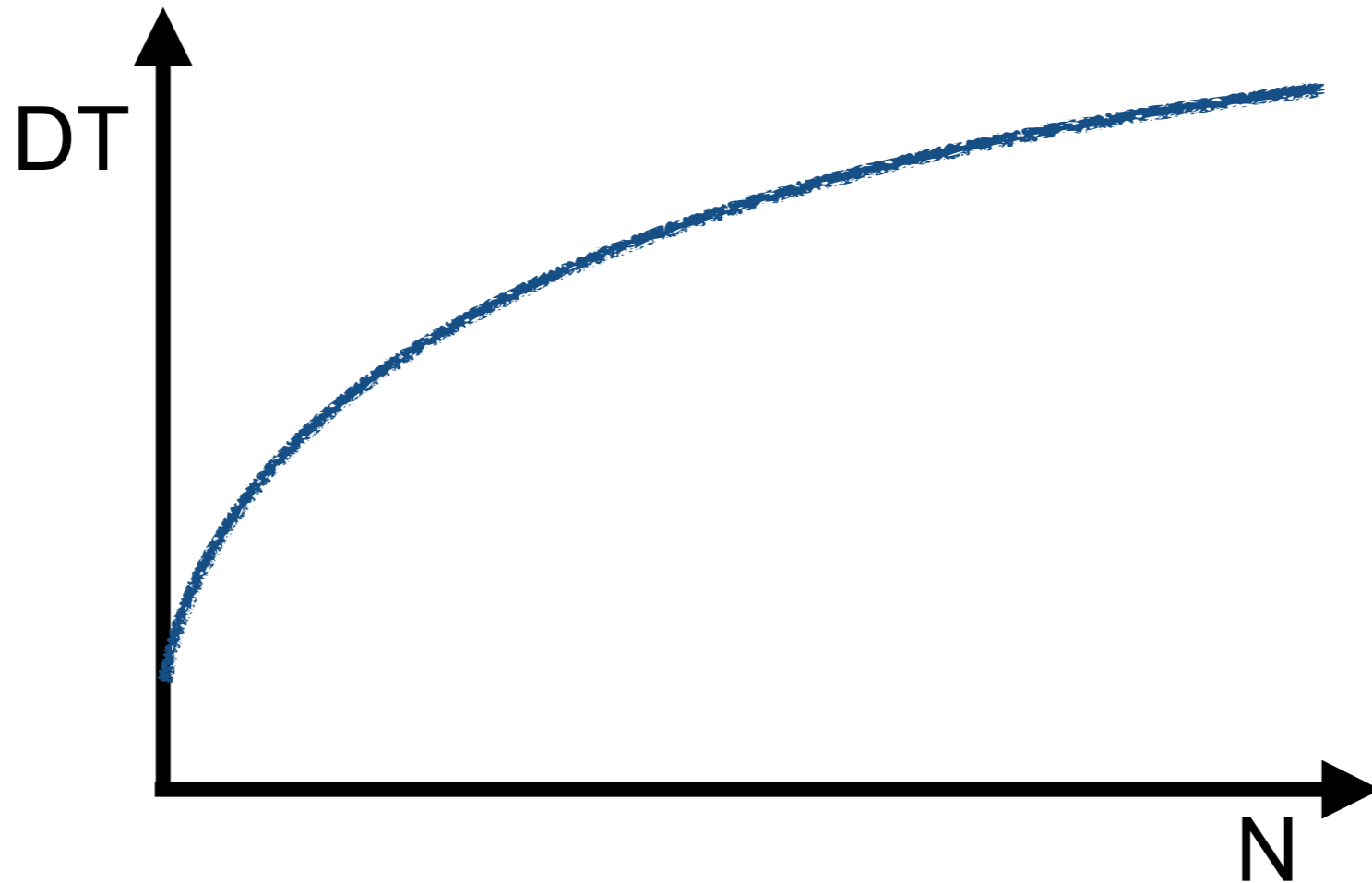
Measurement of Cognitive Load



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Hick-Hyman Law



$$DT = k + z * H_s = k + z * \log_2(N)$$

Example for Hick-Hyman Law (or not?)



<http://www.hier-luebeck.de/wp-content/uploads/2010/09/StartMenueWindows7.jpg>



http://www.photosopic.com/iphone_screen

Hick's Law, explained for a different audience

