

The MURI taxonomy and training for military tasks

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The training MURI project

- **Goal**
 - Provide principles that can be used to predict effects of training on military tasks.
- **Tool: 4-dimensional taxonomy**
 1. Task type
 2. Training method
 3. Performance (context & measures)
 4. Training principles
- **Mechanism: Empirical data and task modeling**
- **How can results be applied to military tasks?**

Applying results to military tasks

- ***Probe taxonomic space***

- ▶ Select simple tasks that can cover a portion of the space
- ▶ Decompose tasks into taxons.
- ▶ Manipulations isolate training and performance effects.
- ▶ Different experiments allow generalization to training principles within taxonomic space.

- ***Analyze military tasks***

- ▶ Military tasks are complex but composed of simple tasks (like laboratory tasks) or task taxons.
- ▶ IMPRINT taxons widely used for describing complex, militarily relevant tasks.
- ▶ The MURI taxons map onto IMPRINT taxons.

Overview

- *MURI/IMPRINT task taxon mapping*
- *Training and performance context dimensions*
- *Planning matrix: MURI coverage of taxonomic space*
- *Taxonomic analysis of RADAR task*
- *Examples of simple tasks in real military tasks*

MURI task taxons and IMPRINT taxons

| MURI Task features | | IMPRINT Taxons | | |
|-----------------------------------|-------------------------------|--|---|---|
| Perception/attentional processing | Visual processing | Visual | | |
| | Language processing (written) | Communication (reading & writing) | | |
| | Auditory processing | | | |
| | Language processing (oral) | Communication (oral) | | |
| | Tactile input | Fine motor - discrete Fine motor - continuous | | |
| Cognitive/affective processing | Synthesis | Executive control/monitoring | Information processing | |
| | | Memory/symbolic representation | Information processing Communication (oral) Communication (reading & writing) | |
| | | Imagery/visual representation | Fine motor - discrete Fine motor - continuous Information processing | |
| | | Concept formation/classification | Information processing | |
| | | Reasoning/problem solving | Numerical Analysis Information processing | |
| | Reponse planning | Motivation/affect Speech planning | Communication (oral) Communication (reading & writing) | |
| | | Motor planning | Fine motor - discrete Fine motor - continuous | |
| | | Physical/communicative response | Manipulation/fine motor | Fine motor - discrete Fine motor - continuous |
| | | | Action/gross motor | Gross motor - light Gross motor - heavy |
| | | | Language/speech production | Communication (reading & writing) Communication (oral) |

Analyzing training and performance

- **Training variables - during skill learning:**

- *How was the skill taught?*
- *What kind of practice did learners get?*
- *How did practice relate to the way the skill will be used?*

Pedagogy

Practice

- **Performance context variables - at skill use:**

- *How does expected performance relate to training?*
- *How long has it been since training?*
- *Did learners get refresher training?*

Performance

Pedagogy parameters

- *Method*
 - ▶ Instruction (= default)
 - ▶ Demonstration
 - ▶ Discovery
 - ▶ Simulation
 - ▶ Immersion
 - ▶ Modeling/mimicking
- *Learning location* (local = default, remote/distance)
- *Discussion/Q&A* (no = default, yes)
- *Individualization* (no = default, yes)

Practice parameters

- ***Scheduling of items in trials and sessions***
 - Number and difficulty of items
 - Spacing (massed = default, spaced, expanding/contracting)
 - Distribution (mixed = default, blocked)
- ***Scope of practiced task*** (partial, whole = default, whole + supplemental)
- ***Depth of processing*** (no = default, yes)
- ***Processing mediation*** (no = default, yes)
- ***Stimulus–response compatibility*** (yes = default, no)
- ***Time pressure*** (no = default, yes)
- ***Feedback*** - presence and type (no = default, all trials, periodic)
- ***Context of practice***
 - Distractor/distractor task (no = default, yes)
 - Secondary activity (no = default, yes)

Performance context parameters

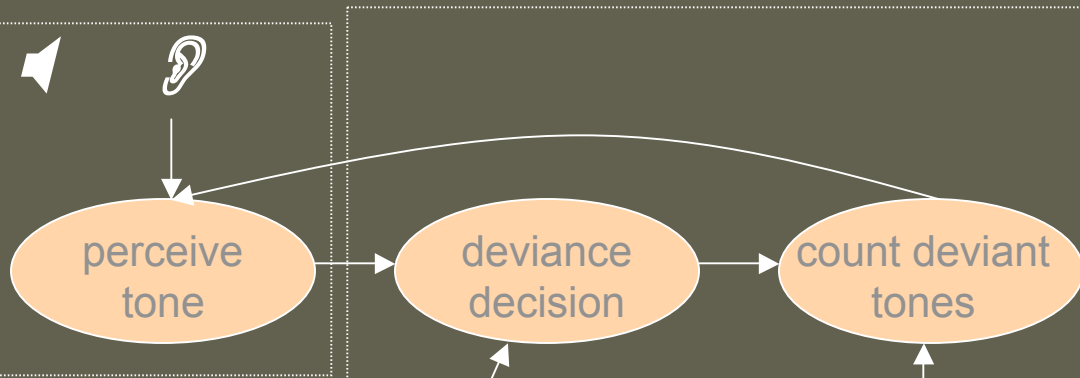
- *Transfer*
 - New items, item order, or distribution of items
 - New context (relative to training)
 - New task (relative to training)
- *Delay interval to task performance*
 - (default = none, time period)
- *Refresher training*
 - (default = no, schedule)

(Planning matrix)

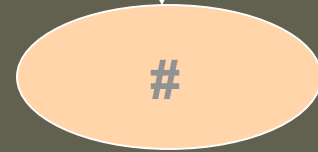
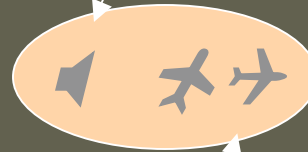
A cognitive model of RADAR (exp 2)

Reasoning/
Problem solving

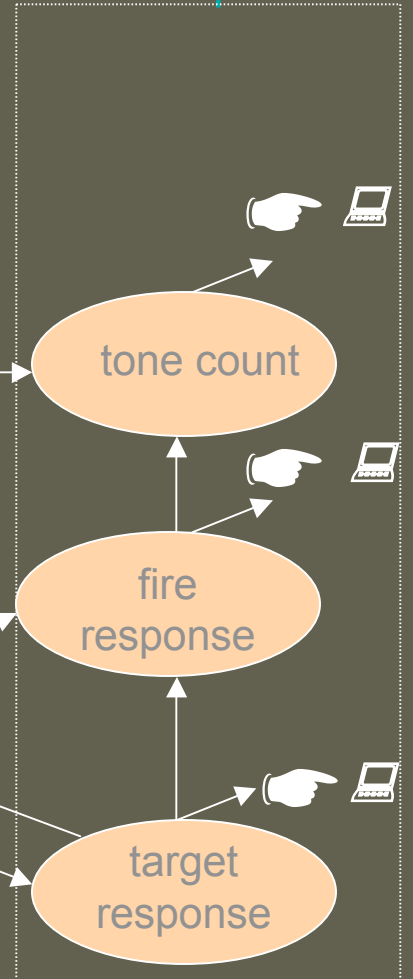
Auditory
processing



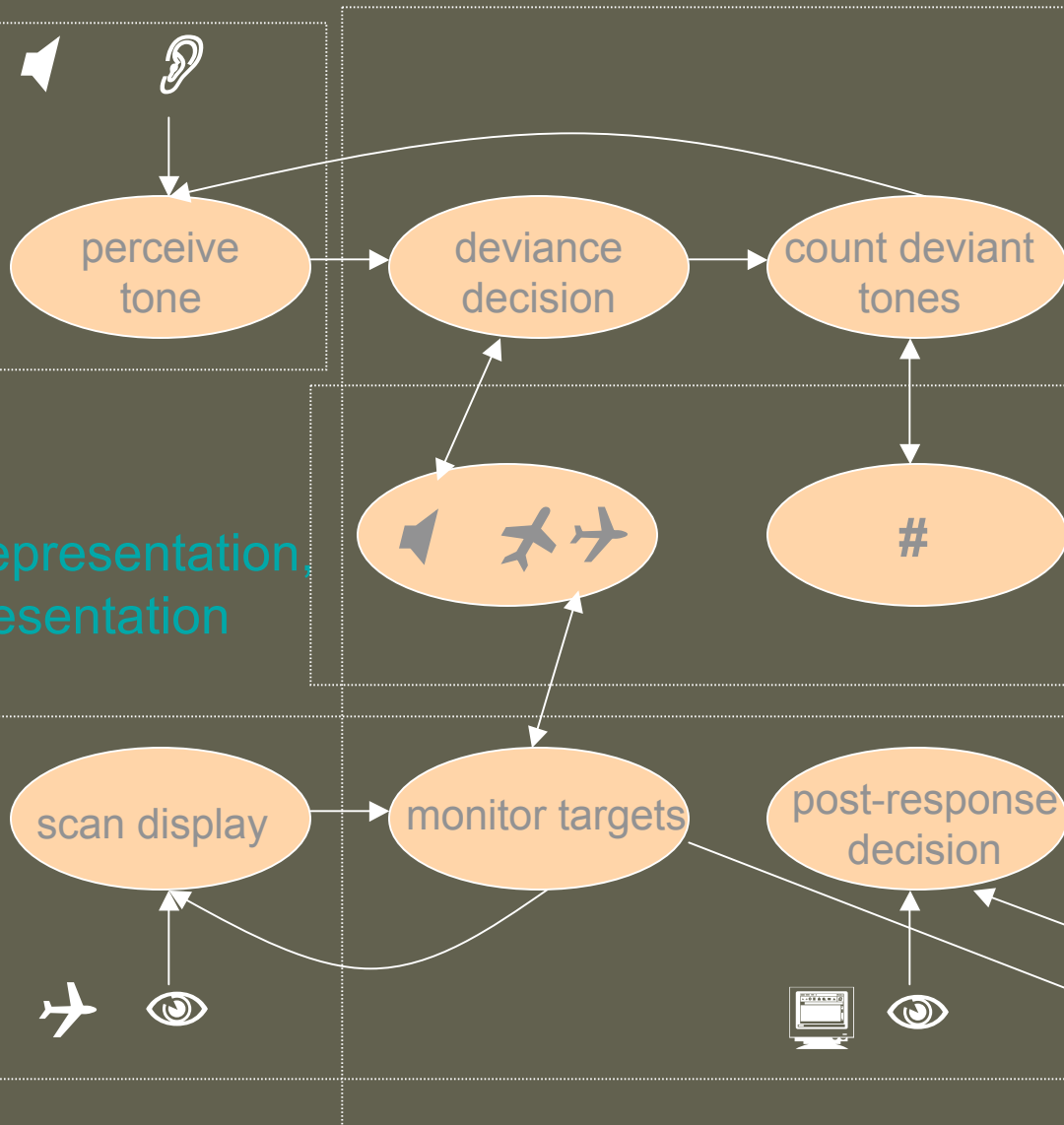
Memory:
Symbolic representation,
Visual representation



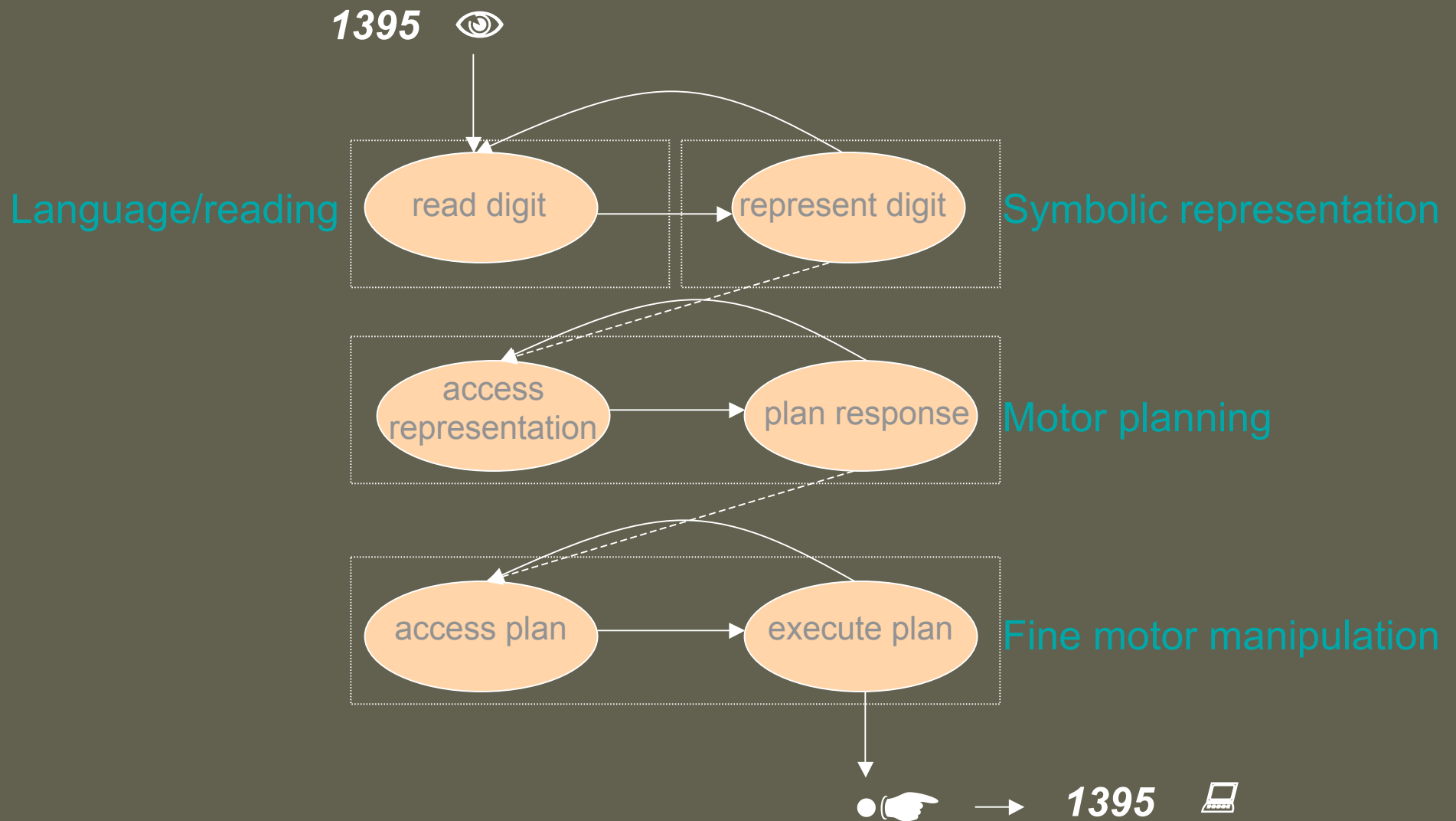
Motor planning,
Motor response



Visual
processing



A cognitive model of digit data entry



RADAR task decomposition

IMPRINT task taxons

| Task components | Training features | | Performance context |
|------------------------|--------------------------------|--|---|
| | Pedagogy | Practice | |
| Visual | <u>Method:</u> • Simulation | <u>Scheduling:</u> • Sessions (blocks, weeks) • Item difficulty (letters/#s, planes) | <u>Transfer:</u> • New task (tone counting; fire decision) |
| Numerical analysis | <u>Method:</u> • Simulation | <u>Scheduling:</u> • Sessions (blocks, weeks) <u>Context:</u> • Distractor (visual detection) • 2ndary task (fire decision) | |
| Information processing | <u>Method:</u> • Simulation | <u>Scheduling:</u> • Sessions (blocks, weeks) • Item difficulty (VM/CM; memory load) <u>Context:</u> • Distractor (tone counting) • 2ndary task (fire decision) | <u>Transfer:</u> • New task (tone counting; fire decision) |
| Fine motor - discrete | <u>Method:</u> • Simulation | | |

Laboratory tasks in military tasks

| | |
|---|---|
| Measure radiation dose rate and total dose | Performance measures: use and maintain dosimeters; measure radiation dose rate/total dose; record results; report finding. Prospective memory, data entry |
| Adjust indirect fire | Performance measures: locate targets; formulate call for fire; determine adjustments; provide end of mission brief; implement fratricide prevention measures; execute risk assessment/management process. Visual search, message comprehension (navigation) |
| Maintain an M16A1/M16A2 rifle | Performance measures: clear, disassemble, clean, inspect, lubricate, assemble, and function check rifle; disassemble, inspect, lubricate, and assemble magazine; inspect and maintain ammunition. Sequence learning |
| Navigate from one point on the ground to another point while dismounted | Performance measures: identify topographic symbols and terrain features on a map; determine grid coordinates/distance using a map; determine grid azimuth using a protractor; convert magnetic azimuth to grid azimuth and grid azimuth to magnetic azimuth; locate an unknown point on a map/ground by intersection/resection; compute back azimuths to degrees/mils; determine magnetic azimuth using a lensatic compass and elevation of a point on the ground using a map; orient a map using a compass and by terrain association; determine location by terrain association; select a movement route using a map. Visual search (radar task), mental calculation, coding, fusion |
| Perform first aid for nerve agent injury | Performance measures: evaluate casualty; identify signs and symptoms of nerve agent poisoning; react to chemical hazard; apply treatment (self aid or buddy aid). Associative learning (declarative knowledge) |
| Conduct OCOKA process integrating threat information | Performance measures: Identify the battlefield's effects on threat and friendly capabilities for terrain analysis observation and fields of fire, concealment and cover, obstacles, key terrain, and avenues of approach (OCOKA). Fusion |

Summary

- *Collect effects (principles) on MURI taxons from experimental manipulations.*
- *Compare and generalize different measures across simple tasks within MURI taxons.*
- *Consolidate generalizations onto IMPRINT taxons.*
- *Apply to military tasks:*
 - Decompose tasks into IMPRINT taxons.
 - OR, Decompose into simple tasks, to the extent possible

END

Data entry tasks in planning matrix

Task, training, and performance matrix

IMPRINT task taxons

| Task components | Training features | | Performance context |
|--|-------------------|-------------------|---------------------|
| | Pedagogy | Practice | |
| Visual <i>Data entry</i> | | <i>Data entry</i> | <i>Data entry</i> |
| Numerical Analysis | | | |
| Information processing <i>Data entry</i> | | <i>Data entry</i> | <i>Data entry</i> |
| Fine motor - discrete <i>Data entry</i> | | <i>Data entry</i> | <i>Data entry</i> |
| Fine motor - continuous | | | |
| Gross motor - light | | | |
| Gross motor - heavy | | | |
| Communication (reading & writing) | | | |
| Communication (oral) | | | |

Task by Pedagogy parameters

IMPRINT task taxons

| Task components | | Pedagogy | | | |
|-----------------------------------|--|---|-------------------|------------------|-----------------|
| | | Method | Learning location | Discussion /Q&A? | Individualized? |
| Visual | <i>Data entry</i> | <i>(Instruction)</i> | | | |
| Numerical Analysis | | | | | |
| Information processing | <i>Data entry</i> <i>Classification</i> | <i>(Instruction)</i> <i>Inst/Discovery</i> | | | |
| Fine motor - discrete | <i>Data entry</i> | <i>(Instruction)</i> | | | |
| Fine motor - continuous | | | | | |
| Gross motor - light | | | | | |
| Gross motor - heavy | | | | | |
| Communication (reading & writing) | | | | | |
| Communication (oral) | | | | | |

Task by performance parameters

IMPRINT task taxons

| Task components | Performance context | | | |
|--|---------------------|---|----------------|--------------------|
| | New context | New task | Delay interval | Refresher training |
| Visual <i>Data entry</i> | | | | |
| Numerical Analysis | | | | |
| Information processing <i>Data entry</i> | | Yes (typing hand, output configuration) | | Yes |
| Fine motor - discrete <i>Data entry</i> | | Yes (typing hand, output configuration) | | Yes |
| Fine motor - continuous | | | | |
| Gross motor - light | | | | |
| Gross motor - heavy | | | | |
| Communication (reading & writing) | | | | |
| Communication (oral) | | | | |