

Submission ID #: 71127

Scriptwriter Name: Kathyayani Sridharan

Project Page Link: <https://review.jove.com/account/file-uploader?src=21693783>

Title: The Grid Learning Task: Examining the Effects of Overlap Type on New Learning Within Healthy Adult Participants

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Author Questionnaire

1. **Microscopy:** Does your protocol require the use of a dissecting or stereomicroscope for performing a complex dissection, microinjection technique, or something similar? **No**
2. **Software:** Does the part of your protocol being filmed include step-by-step descriptions of software usage? **Yes**
3. **Filming location:** Will the filming need to take place in multiple locations? **No**
4. **Testimonials (optional):** Would you be open to filming two short testimonial statements **live during your JoVE shoot**? These will **not appear in your JoVE video** but may be used in JoVE's promotional materials. **No**

Current Protocol Length

Number of Steps: 23

Number of Shots: 71 (55 SC)

Interviews

Videographer: Obtain headshots for all authors available at the filming location.

INTRODUCTION:

~~REQUIRED: Summarize your research focus and the main questions it aims to answer.~~

- 1.1. **Samika Mathada:** Our research focuses on investigating how prior knowledge affects learning information with object or spatial overlap, using an adapted within-subjects Grid Learning Task.

- 1.1.1. INTERVIEW: Named talent says the statement above in an interview-style shot, looking slightly off-camera.

~~Describe the research gap or limitation in existing methods and how this protocol addresses them.~~

- 1.2. **Ananya Mopur:** Unlike previous between-subjects protocols, this adapted within-subjects task tests all overlap types per individual to eliminate confounding individual differences.

- 1.2.1. INTERVIEW: Named talent says the statement above in an interview-style shot, looking slightly off-camera.

CONCLUSION:

~~What does this protocol allow researchers to study or measure?~~

- 1.3. **Seongyun Kim:** The Grid Learning Task measures how prior knowledge affects learning new information, sharing spatial or item features with existing memories.

- 1.3.1. INTERVIEW: Named talent says the statement above in an interview-style shot, looking slightly off-camera.

~~Describe the most important consideration or challenge when performing this protocol.~~

- 1.4. **Samika Mathada:** Participant understanding and sustained engagement are critical for accurately measuring differences in learning attempts during the Grid Learning Task.

- 1.4.1. INTERVIEW: Named talent says the statement above in an interview-style shot, looking slightly off-camera.

~~How can future studies build on this work? Describe the questions or research directions that can be investigated next.~~

- 1.5. **Ananya Mopur**: Future studies could examine how expertise, aging, and brain mechanisms influence the effects of prior knowledge on learning overlapping information.

- 1.5.1. INTERVIEW: Named talent says the statement above in an interview-style shot, looking slightly off-camera.

Videographer: Obtain headshots for all authors available at the filming location.

Ethics Title Card

This research has been approved by the Institutional Review Board (IRB) at the University of California, Riverside

Protocol

***Videographer:** Please always record an audio slate while filming each shot mentioned in the shotlist.*

2. Practice Phase of Grid Learning Task (GLT) in Healthy, Adult Participants

Demonstrators: Samika Mathada (Experimenter), Ananya Mopur (Participant)

- 2.1. To begin, open the [1] Grid Learning Task program using PsychoPy (*Psycho-Pie*) [2]. Click the **Run** button and ensure that the program is not in pilot testing mode [3].
 - 2.1.1. WIDE: Talent sitting at the computer to open the program.
 - 2.1.2. SCREEN: 71127_screenshot_1.mov. 00:07–00:12
 - 2.1.3. SCREEN: 71127_screenshot_1.mov. 00:15–00:20
- 2.2. Instruct participants to enter the pre-assigned participant identification number when prompted [1]. Continue by clicking the **OK** button [2].
 - 2.2.1. Talent entering the participant identification number.
 - 2.2.2. SCREEN: 71127_screenshot_1.mov.00:28–00:31
- 2.3. Start the program [1]. Instruct participants to press the space bar to advance through the instructions [2] as the program indicates the practice phase and the studied grid phase [3].
 - 2.3.1. SCREEN: 71127_screenshot_1.mov. 00:32–00:35
 - 2.3.2. Talent pressing the space bar to advance through the instructions.
 - 2.3.3. SCREEN: 71127_screenshot_1.mov.00:38–00:42
- 2.4. Instruct participants to adjust the screen size by pressing the **Command** key on a Mac or the **Control** key on Windows together with the **plus** or **minus** key until all 4 corners of the grid are visible [1]. Begin the first practice phase by presenting a small 3 by 3 grid containing 1 object [2].
 - 2.4.1. Talent adjusting the screen size until all 4 corners of the grid are visible.
 - 2.4.2. SCREEN: 71127_screenshot_1.mov.00:42–00:45
- 2.5. Display the study screen for 4 seconds [1] and present a fixation cross for the retention interval [2].
 - 2.5.1. SCREEN: 71127_screenshot_1.mov. 00:46–00:48
 - 2.5.2. SCREEN: 71127_screenshot_1.mov. 00:49–00:51
- 2.6. Display an empty grid with the object positioned below the grid [1]. Prompt participants

to position the object appropriately, then provide feedback and allow them to proceed [2].

2.6.1. SCREEN: 71127_screenshot_1.mov. 00:51–00:53

2.6.2. SCREEN: 71127_screenshot_1.mov. 00:54–01:00

- 2.7. Begin the second practice phase [1]. Present a full-sized 8 by 8 grid containing 2 objects [2]. Repeat the same cycle as in the first practice phase, except displaying the study screen for 8 seconds [3].

2.7.1. SCREEN: 71127_screenshot_1.mov. 01:03–01:05

2.7.2. SCREEN: 71127_screenshot_1.mov. 01:08–01:11

2.7.3. SCREEN: 71127_screenshot_1.mov. 01:12–01:17

- 2.8. After participants submit the response, display a feedback screen indicating whether all object locations were placed correctly and proceed to the study phase [1]. Indicate if incorrect [2].

2.8.1. SCREEN: 71127_screenshot_1.mov. 01:20–01:29

2.8.2. SCREEN: 71127_screenshot_3.mov. 00:00–00:01

3. Study Phase of Grid Learning Task

- 3.1. Display the instruction screen indicating the start of the studied grid phase [1]. Have participants begin the phase by pressing the space bar and following the on-screen instructions [2]. Present screens using the same **Study – Fixation – Test – Feedback** cycle and timing as in the second practice phase [3].

3.1.1. SCREEN: 71127_screenshot_1.mov. 01:31– 01:34

3.1.2. Talent pressing the space bar to begin the studied grid phase.

3.1.3. SCREEN: 71127_screenshot_1.mov. 01:35–01:39

- 3.2. Present a study screen containing 8 different everyday objects on a white background, arranged on an 8 by 8 grid [1]. Display the study screen for 8 seconds, then instruct participants to memorize the object locations [2].

3.2.1. SCREEN: 71127_screenshot_1.mov. 01:40–01:46

3.2.2. Talent viewing the study screen to memorize the object locations.

- 3.3. Permit corner-sharing tiles [1]. Present a retention interval screen displaying a fixation cross for 3 seconds [2].

3.3.1. SCREEN: 71127_screenshot_1.mov. 01:46–01:48

3.3.2. SCREEN: 71127_screenshot_1.mov. 01:49–01:52

- 3.4. Then, present an empty 8 by 8 grid with object images randomly arranged below the grid and prompt participants to place each object in its remembered location [1]. Have participants drag and drop each object onto the grid to indicate its remembered location [2]. Automatically center each object within the selected grid tile and allow participants to reposition objects an unlimited number of times before submitting the response [3].
 - 3.4.1. SCREEN: 71127_screenshot_1.mov. 01:53–02:02
 - 3.4.2. Talent dragging and dropping objects onto the grid.
 - 3.4.3. SCREEN: 71127_screenshot_1.mov. 02:05–02:11
- 3.5. Once participants are satisfied with the placements, instruct them to press the space bar to submit the response, allowing the self-paced test phase to proceed with no time limit [1]. Display a feedback screen indicating the number of correctly placed objects without identifying which objects were placed correctly [2].
 - 3.5.1. Talent pressing the space bar to submit the response.
 - 3.5.2. SCREEN: 71127_screenshot_1.mov. 02:11 *Video Editor: Please show the static screen at this timestamp until the VO is completed.*
- 3.6. Repeat the study phase cycle until all 8 objects are placed correctly or until 10 cycles have been completed [1]. Then, allow the program to automatically advance to the math distractor task [2].
 - 3.6.1. SCREEN: 71127_screenshot_1.mov. 02:15–02:18; 02:24–02:25; 02:27–02:32 02:39–02:41
 - 3.6.2. SCREEN: 71127_screenshot_1.mov. 02:42 *Video Editor: Please show the static screen at this timestamp until the VO is completed.*

4. Math Distractor Test of GLT

- 4.1. Begin the math distractor task [1]. Instruct participants to read the on-screen instructions and complete simple arithmetic problems before proceeding to the next grid [2]. Present simple arithmetic problems involving addition or subtraction one at a time on the screen [3]. Instruct participants to indicate whether each equation is correct or incorrect by pressing **T** for true or **F** for false [4].
 - 4.1.1. SCREEN: 71127_screenshot_1.mov. 02:43–02:45
 - 4.1.2. SCREEN: 71127_screenshot_1.mov. 02:46–02:47 *Video Editor: Please show the static screen with the instructions at this timestamp until the VO is completed.*
 - 4.1.3. SCREEN: 71127_screenshot_1.mov. 02:49–02:52
 - 4.1.4. Talent pressing **T** or **F** to answer the equation.
- 4.2. Display a feedback screen after each response, indicating whether the response was

correct or incorrect [1]. If no response is made within 4 seconds, automatically advance to the feedback screen and display a message prompting participants to respond more quickly [2].

4.2.1. SCREEN: 71127_screenshot_1.mov. 02:53–02:54 *Video Editor: Please show the static screen with the feedback at this timestamp until the VO is completed.*

4.2.2. SCREEN: 71127_screenshot_1.mov. 02:59–03:04

4.3. Allow participants to complete 20 arithmetic questions before proceeding to the next grid, ensuring completion of the distractor task in approximately 1 minute [1].

4.3.1. SCREEN: 71127_screenshot_1.mov. 03:12–03:19

5. Determination of Overlap Manipulation

5.1. After completion of the math distractor task, display on-screen instructions indicating that the next grid will begin [1]. Instruct participants to press the space bar to start the next trial [2]. Repeat the **Study – Fixation – Test – Feedback** cycle for the subsequent grid [3]. Across the task, have participants learn 4 different grids separated by math distractor tasks [4].

5.1.1. SCREEN: 71127_screenshot_1.mov. 03:59–04:02. *Video Editor: Please show the static screen with the instructions at the end until the VO is completed.*

5.1.2. Talent pressing the space bar to start the next trial.

5.1.3. SCREEN: 71127_screenshot_1.mov. 04:06–04:10; 04:15–04:17; 04:18–04:23; 04:35. *Video Editor: Please show the static screen at 04:35 until the VO is completed.*

5.1.4. SCREEN: 71127_screenshot_1.mov. 00:45, 04:08, 07:40, 10:38 *Video Editor: Please emphasize each grid sequentially.*

5.2. Configure the 4 grids so that 2 consecutive grids share the same object images but different locations [1], and another pair of consecutive grids shares the same spatial layout but different object images [2]. Construct the 4 studied grids from the predefined object and location sets [3].

5.2.1. LAB MEDIA: Figure 2. Panels A and B. Video Editor: Please emphasize the same objects present in different locations in panels A and B.

5.2.2. LAB MEDIA: Figure 2. Panels B and C. Video Editor: Please emphasize the different objects present in the same locations in panels B and C.

5.2.3. SCREEN: 71127_screenshot_2.mov. 00:00–00:04

5.3. Randomly select grids so that one transition represents the Object overlap condition [1], one transition represents the Location overlap condition [2], and 1 transition represents the No overlap condition [3].

- 5.3.1. LAB MEDIA: Figure 2. *Video Editor: Please emphasize the text “Object Overlap Learning Difficulty Score” at the bottom of panels A and B.*
- 5.3.2. LAB MEDIA: Figure 2. *Video Editor: Please emphasize the text “Location Overlap Learning Difficulty Score” at the bottom of panels B and C.*
- 5.3.3. LAB MEDIA: Figure 2. *Video Editor: Please emphasize the text “No Overlap Learning Difficulty Score” at the bottom of panels C and D.*
- 5.4. For the Object overlap condition, use the same object set across 2 consecutive grids while assigning different location sets [1]. For the Location overlap condition, use the same location set across 2 consecutive grids while assigning different object sets [2]. For the No overlap condition, use different object sets and different location sets across consecutive grids [3]. Randomly assign and fully counterbalance overlap-condition order across participants, resulting in 6 possible overlap orders [4].
 - 5.4.1. SCREEN: 71127_screenshot_1.mov. 01:41–01:43; 04:08–04:11
 - 5.4.2. SCREEN: 71127_screenshot_1.mov. 05:50–05:53; 07:40–07:43
 - 5.4.3. SCREEN: 71127_screenshot_1.mov. 08:15–08:18; 10:40–10:43
 - 5.4.4. Talent assigning overlap conditions resulting in 6 overlap orders. **Authors**
NOTE: Use static shot from 71128_screenshot_2.mov (at 00:05)
- 5.5. Present a different set of 20 arithmetic questions during each distractor phase, resulting in 3 unique question sets across the experiment [1]. After completing the fourth grid, display the end-of-task screen [2]. Instruct participants to press the space bar to exit the program [3].
 - 5.5.1. SCREEN: 71127_screenshot_1.mov. 09:13; 09:20–09:27 *Video Editor: Please show the instruction on a static screen at timestamp 09:13 for 2-3 seconds and then show the timestamp 09:20–09:27*
 - 5.5.2. SCREEN: 71127_screenshot_1.mov. 12:13 *Video Editor: Please show the static screen indicating the end of experiment at this timestamp.*
 - 5.5.3. Talent pressing the space bar to exit the program.

Results

6. Results

6.1. The number of learning attempts decreased numerically across grids, from Grid 1 through Grid 4 [1].

6.1.1. LAB MEDIA: Table 1. *Video Editor: Please emphasize the values corresponding to row "M" decreasing through columns 1 to 4.*

6.2. Learning difficulty scores as a function of overlap type indicated that, compared to the No Overlap condition [1], scores were higher in the Object Overlap condition [2] but numerically lower in the Location Overlap condition [3].

6.2.1. LAB MEDIA: Figure 3. *Video Editor: Please emphasize the central grey plot corresponding to the "No overlap" label on X-axis.*

6.2.2. LAB MEDIA: Figure 3. *Video Editor: Please emphasize the left blue plot corresponding to the "Object overlap" label on X-axis.*

6.2.3. LAB MEDIA: Figure 3. *Video Editor: Please emphasize the right yellow plot corresponding to the "Location overlap" label on X-axis.*

1. PsychoPy

Pronunciation link: No confirmed link found

IPA: /'saɪkoʊ paɪ/

Phonetic Spelling: SY·koh·pie

2. Fixation

Pronunciation link: <https://www.merriam-webster.com/dictionary/fixation>

IPA: /fɪk'seɪʃən/

Phonetic Spelling: fik·SAY·shuhn

3. Retention

Pronunciation link: <https://www.merriam-webster.com/dictionary/retention>

IPA: /rɪ'tenʃən/

Phonetic Spelling: rih·TEN·shuhn

4. Arithmetic

Pronunciation link: <https://www.merriam-webster.com/dictionary/arithmetic>

IPA: /ə' rɪθmətɪk/

Phonetic Spelling: uh·RITH·muh·tik

5. Distractor

Pronunciation link: <https://www.merriam-webster.com/dictionary/distractor>

IPA: /dɪ'stræktər/

Phonetic Spelling: dih·STRAK·ter

6. Manipulation
Pronunciation link: <https://www.merriam-webster.com/dictionary/manipulation>
IPA: /məˌnɪpjəˈleɪʃən/
Phonetic Spelling: muh·nip·yuh·LAY·shuhn
7. Subsequent
Pronunciation link: <https://www.merriam-webster.com/dictionary/subsequent>
IPA: /ˈsʌbsɪkwənt/
Phonetic Spelling: SUB·sɪh·kwuhnt
8. Predefined
Pronunciation link: <https://www.merriam-webster.com/dictionary/predefined>
IPA: /ˌpriːdɪˈfaɪnd/
Phonetic Spelling: pree·dih·FYND
9. Counterbalance
Pronunciation link: <https://www.merriam-webster.com/dictionary/counterbalance>
IPA: /ˌkaʊntərˈbæləns/
Phonetic Spelling: kown·ter·BAL·uhns
10. Counterbalanced
Pronunciation link: <https://www.merriam-webster.com/dictionary/counterbalanced>
IPA: /ˌkaʊntərˈbælənst/
Phonetic Spelling: kown·ter·BAL·uhnst
11. Numerically
Pronunciation link: <https://www.merriam-webster.com/dictionary/numerical>
IPA: /nuːˈmerɪkli/
Phonetic Spelling: noo·MAIR·ik·lee