

WISCONSIN GENERAL TESTING APPARATUS (WGTA)

The WGTA apparatus (described in Harlow, 1959) is used for a battery of tests including Black/White Discrimination, Black/White Reversal, Hamilton Search, Hamilton Search Set Breaking, Hamilton Search Forced Set Breaking, and Learning Set. The following is a general description of the procedures for each task. READ EVERY PART OF THIS PROTOCOL CAREFULLY.

Procedures for All Phases

1. Always check to make sure that the apparatus is working properly—door closes completely, clock works properly, etc., *before* start of testing.
2. Check to see whether any of the subjects assigned to you are sick or otherwise not to be run.
3. Transfer all animals to and from the apparatus in transport cages.
4. Keep interaction with the animals to a minimum; do not interact at all while the animal is in the apparatus, except as specifically noted in the protocols.
5. Clean the transport cage after each use.
6. Clean the WGTA cage with a spray-on disinfectant between animals, and wash it at the end of the day.

General Information—WGTA Testing

1. The data sheets used for WGTA testing are forms 18-39 in the Appendix. The heading on the data sheets includes the same basic information for all tasks: Animal number, Problem, Tester, Date, and Time. Enter all information in pencil for easy editing.

Animal code: Enter the animal's six-digit number.

Problem codes:

- 01 Black/White Discrimination Adaptation
- 02 Black/White Discrimination, White Rewarded
- 03 Black/White Discrimination, Black Rewarded
- 04 Black/White Reversal, White Previously Rewarded
- 05 Black/White Reversal, Black Previously Rewarded
- 06 Hamilton Search Adaptation
- 07 Hamilton Search

- 08 Hamilton Search Set Breaking
- 09 Hamilton Search Forced Set Breaking
- 11 Learning Set—A Rewarded
- 12 Learning Set—B Rewarded

For Learning Set, enter the stimulus pair number at the top of the box for each problem.

Tester code: A 2-digit experimenter number will be assigned to anyone running WGTA experiments.

Date code: Enter month, day and year as six digits.

Time code:

- 1 until 12 noon
- 2 12 noon until 5 p.m.
- 3 after 5 p.m.

Error Codes

- 1 Subject makes choices but fails to choose correct box after 3 min; testing continues
 - 2 Subject makes no choice within 3 min; after 5 consecutive balks, end testing
 - 3 Subject balks due to external noise
 - 4 Missing data due to timer failure
 - 9 Trial not run
2. Record latencies in the space provided, rounded to the nearest second (i.e., 18.4 sec = 18, 18.7 sec = 19, 19.5 sec = 20).
 3. Run each animal according to the condition in its home cage; e.g., give it a diaper if it has one in its home cage, but otherwise don't.
 4. If an animal will not run for 3 min on five successive trials, terminate the run. In any case, an animal must receive five trials in a day, even if all are balks. If an animal does not make a correct choice in Hamilton Search in 3 min, enter a -1 in the latency column and go on to the next trial.
 5. Do not talk to the animals.
 6. Set up each run after the animal has been placed in the testing cage.
 7. Always note any mistakes you make and report them to the supervisor.

8. Record any behavior that is out of the ordinary; e.g., an animal acts terrified of an object in the Learning Set and refuses to respond or responds only to the other object (be it a rewarded one or not).
9. If balking or other circumstances not covered by this protocol arise, see your supervisor.

Problem 01—Black/White Adaptation

Use Yellow Block for adaptation.

For each stage, run each subject to a criterion of five trials in a row, each having a latency of 60 sec or less. Each animal receives a maximum of 25 trials per day. Each trial has a maximum time limit of 180 sec (3 min). If an animal does not complete a given stage within 25 trials, stop testing for that day and start on the same stage the next day. If an animal balks (no response for 3 min in five successive trials) under these circumstances, move back one stage at a time until it responds. Then proceed with adaptation. During all stages of adaptation, lower the screen between trials and keep the one-way mirror screen down. *Start with Stage 2*, running Stage 1 only if the animal will not do Stage 2 for 5 consecutive test days.

Stage 1. Run this stage only if the animal balks at Stage 2 for a week. Run the animal to criterion, offering it food from your hand, with your hand centered between the food wells.

Stage 2. Using the Gellerman randomization order, place reward in front of the food well.

Stage 3. Using Gellerman, place reward *in* the food well.

Stage 4. Same as 3, but place the adaptation block in back of the food well.

Stage 5. Cover the food well half with the adaptation block, using the same procedure.

Stage 6. Cover the reward completely with the object, using the same procedure. Run 23/25 of stage 6 for adaptation. For this stage of adaptation only, trials do *not* have to be under 1 min.

NOTE: For Black/White Adaptation *only*, record balks as follows:

			<i>Latency</i>	<i>Stage</i>	
1	R	1	180	6	-2
2	L	0	18	6	1
3	R	1	180	6	-2

In trials 1 and 3 of this example, the animal balked. In trial 2 it responded correctly after 18 sec.

Problem 02—Black/White Discrimination, White Rewarded**Problem 03—Black/White Discrimination, Black Rewarded**

1. Always reward either black or white for each animal. If you start your first animal with black, then start your second with white, your third animal with black, etc. In this way all animals will not be having the same color reward for Black/White Discrimination.
2. Use the Gellerman series form for this test (Appendix, forms 19-23). Begin your first animal with Series I, your second animal with Series II, etc. The different Gellerman series represent different randomizations of right/left reward.
3. Rewarding *one color only* for each animal, cover the appropriate well following the Gellerman randomization schedule. Criterion is 23 correct choices in 25 trials.
4. A balk is scored in Black/White Discrimination and Reversal when the subject has not responded for 3 min on five consecutive trials. The animal must be tested for five trials, which can include the balk trials, on any given day.
5. Scoring: Always enter correct latencies in the left-hand column of the form and incorrect latencies in the right-hand column. In the far right-hand column, indicate whether the animal made the correct choice (code 1) or an incorrect choice (code 0). All this scoring procedure facilitates data entry. A balk (code -2) should be written across the latency columns, and no mark made in the far right-hand column. If five balks occur in a row and testing is terminated, fill remaining blank columns with -9, in the same fashion as a balk is filled in.

Problem 04—Black/White Reversal, White Previously Rewarded**Problem 05—Black/White Reversal, Black Previously Rewarded**

1. After an animal has run to criterion on Black/White Discrimination, begin Black/White Reversal. On this task reward black if white was rewarded on the initial discrimination series, and white if black was rewarded on the discrimination series. Always begin a new data sheet when Reversal is begun.
2. Reward the appropriate well according to the Gellerman randomization schedule (Appendix, forms 19-23). Run Black/White Reversal until the animal reaches criterion (23 correct responses in 25 trials).
3. The scoring is the same as for Black/White Discrimination: use the left-hand column for correct latencies and the right-hand column for incorrect latencies. Again, use the far right column to indicate whether the response was correct (code 1) or not (code 0). Code -2 (balk) extends across latency columns.

Problem 06—Hamilton Search Adaptation

1. Adaptation for Hamilton Search is done in two days (unless the animal has not learned how to manipulate the box). Using the single green box, begin adaptation

with Stage 1. Record latency and stage on the Hamilton Search Adaptation Sheet (Appendix, form 24). If an animal balks on any one stage five times in a row, return to the previous stage the next testing day.

Stage 1. Place a reward in the box and hold the lid open. When the animal has responded five times in a row with latencies of less than 60 sec, continue to Stage 2.

Stage 2. Place a reward in the box, holding the box half open with your hand. Criterion is the same as in stage 1.

Stage 3. Place a reward in the box and leave the box closed. Criterion is correct responses on 23/25 trials. This stage will take an entire testing session.

Problem 07—Hamilton Search

1. The four little yellow boxes are used for this task. On the back of each box is a letter to help you randomize the box order each day. It doesn't matter what order the boxes are in. Just make sure that the boxes are in a different order for each animal each day. Make a note of the box order on the Hamilton Search data sheet.
2. There are three Hamilton Search data sheets, each with a different randomization schedule for the baited box. Do not use the same series sheet two days in a row. (See Appendix, forms 25-27.)
3. The Hamilton Search boxes are numbered 1-4 as seen from the experimenter's left to right. The numbers 1-4 refer to position. For each trial, bait the box listed in the order or "bait" column in the data sheet. For example:

A	C	B	D
1	2	3	4

4. After the correct box is baited, be sure all four boxes are completely closed, raise the door, start the timer, and record the order of box openings in the spaces marked Box 1, Box 2, Box 3, and Box 4. For example:

Box 1	Box 2	Box 3	Box 4
4	2	5	1,3

In this example, Box 1 was the fourth box opened; Box 2, the second; Box 3, the fifth; and Box 4, the first and third. The Box 3 answer is circled because it is the correct response. Run 25 trials. Record latency to correct choice for each trial in the space marked "latency."

NOTE: The subject only needs to *open* the correct box to terminate the trial—be sure the animal receives the reward, but do not record the time it takes to remove the reward.

5. Summary. To facilitate data entry, you must summarize your own data. In the column marked first choice, enter the first choice the animal made. In the case of the previous example, enter a 4 because Box 4 was opened first. In the four spaces following "first choice," enter how many times each of the boxes was opened. If a box was not opened at all during the trial, enter a 0. Do not leave the space blank.
6. Run the Hamilton Search Problem for 5 days. Balks during the run are acceptable; however, if five balks in a row occur (resulting in termination of testing), that day cannot count as one of the 5 days.
7. Remember: An incident in which an animal makes choices but doesn't make the correct response has an error code of -1. This does not count as a balk.

Problem 08—Hamilton Search Set Breaking

1. After Hamilton Search has been run for 5 days, determine which box was the least preferred. To do this, enter in a table how many times each was opened *first* for each day. For example:

	Box 1	Box 2	Box 3	Box 4
Day 1	10	3	8	4
Day 2	8	5	6	6
Day 3	11	2	8	4
Day 4	7	3	10	5
Day 5	6	4	8	7
Total	42	(17)	40	26

Across each day, the number of first lid openings should add up to 25 since there are 25 trials per day. In this case, Box 2 was opened first the least number of times.

2. The least preferred box is always baited for Hamilton Search Set Breaking. On the data sheet (Appendix, form 28) mark in red each of the entries in the "bait" column with the number of the least preferred box.
3. Run Hamilton Search Set Breaking the same as Hamilton Search—only reward the same least-preferred box for each of the 25 trials. Enter the order the boxes are opened in the same manner and summarize data in the same way.
4. Hamilton Search Set Breaking is run for 5 days. (Again, if an animal balks five times in a row resulting in termination of testing, that day cannot count as one of the 5 days.)

Problem 09—Hamilton Search Forced Set Breaking

1. For this problem, bait the same least preferred box as in Set Breaking for all 25 trials.
2. The *difference* between Forced Set Breaking and Set Breaking is that in Forced Set Breaking, the animal is given the opportunity to open only one lid before the door is brought down. It is extremely important that the animal not be allowed to make more than one choice, no matter how fast it is. Be faster.
3. Scoring for Forced Set Breaking is the same as for Set Breaking and Hamilton Search, except that there is just one entry per trial in the spaces provided for the order of box openings (Appendix, form 29).

4. In Forced Set Breaking, the summary is somewhat simplified. It is still necessary to indicate the first choice (which is the only choice), but there is no need to fill in the spaces to indicate how many times each box was opened.
5. Hamilton Forced Set Breaking is run for five days. The same balk rule as in Problems 07 and 08 applies.

Problem 11—Learning Set, A Rewarded
Problem 12—Learning Set, B Rewarded

1. There is no adaptation for Learning Set.
2. Learning Set is run for 36 trials per day (six item pairs, six trials with each pair).
3. In the WGTA run, there are 240 pairs of toys bagged in sets of six pairs each. Each box of toys represents 5 days of testing or running. The toys in each pair are labeled A or B. For any given animal, always reward either the A toy or the B toy throughout the 240 sets of toys. In other words, for a particular animal, A is rewarded all the time or B is rewarded all the time.
4. Each bag of toys represents a day of running. Begin running with the bag labeled 1-6 for the first day, 7-12 for the second day, etc. Write down the number of the pair of toys consecutively on the data sheets—on top of the data block for that particular set of toys.
5. Present each pair of toys to the animal six times, representing six trials per pair. Present six pairs of toys per day.
6. Learning Set is run similar to Black/White Discrimination. Place the reward in the wells according to the randomization schedule on the six-trial discrimination forms (Appendix, forms 30-39).
7. Enter the latency for a correct choice in the left column and the latency for an incorrect choice in the right column. Then in the far right column, enter a 1 if the choice was correct and a 0 if the choice was incorrect.
8. Learning Set takes approximately 8 weeks to run.
9. Balking is defined as 180 sec of no response. If the subject balks for 5 consecutive trials (this can occur over two toy sets), stop testing. Do not present the same toys to the animal on the next day's run, e.g., if an animal stops running on pair #157, start with set #158 the next day, finishing that six-pair bag of toys. For example, if four pairs had been run successfully before the animal balked, run only five and six the next day. Start the following test session with the next six pairs.

WGTA Data Processing

After data are collected for individual animals on the entire WGTA process, they are edited for computer entry. This edit is to ensure that testers have put all relevant information on the animal's daily data sheets (i.e., animal number, problem number, date, time, tester number) and that the data are presented correctly, with all data information available.

Be sure that your data sheets are completely filled out, as any errors in the data are difficult and time consuming to rectify.

References

Boothe, R. and Sackett, G. Perception and learning in infant rhesus monkeys. In G. Bourne (ed.), *The Rhesus Monkey*, p. 343-363. New York: Academic Press, 1975.

Harlow, H. The development of learning in the rhesus monkey. *American Scientist* 45:459-479, 1959.