

The hypothesis spaces learned by our test PMSI for all domains at once. Useful primitives for the Language Queries, Equation Solving, and Robot Planning domains are **orange**, **blue**, and **green**, respectively. Notice how it's learned action chunks are naturally from separate domains. We did not explicitly tell it to do this.

DQN #6 (lowest level)

1. (**after_to_before**)
2. (**in-back-of_to_in-front-of**)
3. (**because_to_before**)
4. (**chain_before_relations**)
5. (**in-front-of_to_before**)
6. (**years_to_after**)
7. (**check_if_solution_is_explicit**)
8. (**simplify_products**)
9. (**simplify_fractions**)
10. (**add_like_terms**)
11. (**divide_by_relevant_multiple**)
12. (**apply_quadratic_formula**)
13. (**update_innerese_world_representation**)
14. (**attempt_to_place_x_on_y**)
15. (**unstack_item_above_x_to_reach_x**)
16. (**unstack_item_above_y_to_make_room_for_x**)

DQN #5

1. (**in-back-of_to_in-front-of**)
2. (**because_to_before**)
3. (**simplify_fractions**)
4. (**unstack_item_above_y_to_make_room_for_x => update_innerese_world_representation**)
5. (**add_like_terms => divide_by_relevant_multiple => check_if_solution_is_explicit**)
6. (**in-front-of_to_before => chain_before_relations**)

7. (unstack_item_above_y_to_make_room_for_x => attempt_to_place_x_on_y)
8. (unstack_item_above_x_to_reach_x => attempt_to_place_x_on_y)
9. (apply_quadratic_formula => check_if_solution_is_explicit)
10. (simplify_products => add_like_terms)
11. (after_to_before => chain_before_relations)
12. (years_to_after => after_to_before)

DQN #4

1. (in-front-of_to_before => chain_before_relations)
2. (after_to_before => chain_before_relations)
3. (years_to_after => after_to_before)
4. (simplify_products => add_like_terms => apply_quadratic_formula => check_if_solution_is_explicit)
5. (unstack_item_above_y_to_make_room_for_x => attempt_to_place_x_on_y =>
unstack_item_above_y_to_make_room_for_x => update_innerese_world_representation =>
because_to_before)
6. (unstack_item_above_y_to_make_room_for_x => attempt_to_place_x_on_y =>
unstack_item_above_x_to_reach_x => attempt_to_place_x_on_y)
7. (simplify_fractions => simplify_products => add_like_terms)
8. (attempt_to_place_x_on_y => in-back-of_to_in-front-of => because_to_before)
9. (simplify_fractions => add_like_terms => divide_by_relevant_multiple => check_if_solution_is_explicit)

DQN #3

1. (years_to_after => after_to_before)
2. (simplify_products => add_like_terms => apply_quadratic_formula => check_if_solution_is_explicit)
3. (unstack_item_above_y_to_make_room_for_x => attempt_to_place_x_on_y =>
unstack_item_above_y_to_make_room_for_x => update_innerese_world_representation =>
because_to_before)
4. (attempt_to_place_x_on_y => in-back-of_to_in-front-of => because_to_before => in-front-of_to_before =>
chain_before_relations)
5. (simplify_fractions => simplify_products => add_like_terms => simplify_fractions => add_like_terms =>
divide_by_relevant_multiple => check_if_solution_is_explicit)
6. (unstack_item_above_y_to_make_room_for_x => attempt_to_place_x_on_y =>
unstack_item_above_x_to_reach_x => attempt_to_place_x_on_y =>
unstack_item_above_y_to_make_room_for_x => attempt_to_place_x_on_y)

7. (attempt_to_place_x_on_y => in-back-of_to_in-front-of => because_to_before => after_to_before => chain_before_relations)

DQN. #2

1. (simplify_products => add_like_terms => apply_quadratic_formula => check_if_solution_is_explicit)
2. (unstack_item_above_y_to_make_room_for_x => attempt_to_place_x_on_y => unstack_item_above_y_to_make_room_for_x => update_innerese_world_representation => because_to_before)
3. (simplify_fractions => simplify_products => add_like_terms => simplify_fractions => add_like_terms => divide_by_relevant_multiple => check_if_solution_is_explicit)
4. (attempt_to_place_x_on_y => in-back-of_to_in-front-of => because_to_before => after_to_before => chain_before_relations)
5. (years_to_after => after_to_before => attempt_to_place_x_on_y => in-back-of_to_in-front-of => because_to_before => in-front-of_to_before => chain_before_relations)
6. (unstack_item_above_y_to_make_room_for_x => attempt_to_place_x_on_y => unstack_item_above_x_to_reach_x => attempt_to_place_x_on_y => unstack_item_above_y_to_make_room_for_x => attempt_to_place_x_on_y => unstack_item_above_y_to_make_room_for_x => attempt_to_place_x_on_y => unstack_item_above_x_to_reach_x => attempt_to_place_x_on_y)

DQN #1 (top level)

1. (simplify_products => add_like_terms => apply_quadratic_formula => check_if_solution_is_explicit)
2. (simplify_fractions => simplify_products => add_like_terms => simplify_fractions => add_like_terms => divide_by_relevant_multiple => check_if_solution_is_explicit)
3. (attempt_to_place_x_on_y => in-back-of_to_in-front-of => because_to_before => after_to_before => chain_before_relations)
4. (years_to_after => after_to_before => attempt_to_place_x_on_y => in-back-of_to_in-front-of => because_to_before => in-front-of_to_before => chain_before_relations)
5. (unstack_item_above_y_to_make_room_for_x => attempt_to_place_x_on_y => unstack_item_above_y_to_make_room_for_x => update_innerese_world_representation => because_to_before => unstack_item_above_y_to_make_room_for_x => attempt_to_place_x_on_y => unstack_item_above_x_to_reach_x => attempt_to_place_x_on_y => unstack_item_above_y_to_make_room_for_x => attempt_to_place_x_on_y => unstack_item_above_y_to_make_room_for_x => attempt_to_place_x_on_y => unstack_item_above_x_to_reach_x => attempt_to_place_x_on_y => unstack_item_above_y_to_make_room_for_x => attempt_to_place_x_on_y => unstack_item_above_x_to_reach_x => attempt_to_place_x_on_y => unstack_item_above_y_to_make_room_for_x => attempt_to_place_x_on_y => unstack_item_above_y_to_make_room_for_x => attempt_to_place_x_on_y => unstack_item_above_x_to_reach_x => attempt_to_place_x_on_y)

The hypothesis spaces learned by our test PMSI for the [Language Queries](#) domain.

DQN #4 (lowest level)

1. ([years_to_after](#))
2. ([after_to_before](#))
3. ([because_to_before](#))
4. ([in-back-of_to_in-front-of](#))
5. ([in-front-of_to_before](#))
6. ([chain_before_relations](#))

DQN #3

1. ([in-front-of_to_before](#) => [chain_before_relations](#))
2. ([because_to_before](#) => [chain_before_relations](#))
3. ([after_to_before](#) => [chain_before_relations](#))
4. ([years_to_after](#))
5. ([in-back-of_to_in-front-of](#))

DQN# 2

1. ([in-back-of_to_in-front-of](#) => [in-front-of_to_before](#) => [chain_before_relations](#))
2. ([chain_before_relations](#) => [because_to_before](#) => [chain_before_relations](#))
3. ([after_to_before](#) => [chain_before_relations](#))
4. ([years_to_after](#))

DQN #1 (top level)

1. ([in-back-of_to_in-front-of](#) => [in-front-of_to_before](#) => [chain_before_relations](#))
2. ([chain_before_relations](#) => [because_to_before](#) => [chain_before_relations](#))
3. ([years_to_after](#) => [after_to_before](#) => [chain_before_relations](#))

The hypothesis spaces learned by PMSI for the [Equation Solving](#) domain.

DQN #2 (lowest level)

1. ([add_like_terms](#))
2. ([simplify_fractions](#))
3. ([simplify_products](#))
4. ([apply_quadratic_formula](#))
5. ([divide_by_relevant_multiple](#))
6. ([check_if_solution_is_explicit](#))

DQN #1 (top level)

1. ([divide_by_relevant_multiple](#) => [check_if_solution_is_explicit](#))
2. ([apply_quadratic_formula](#) => [check_if_solution_is_explicit](#))
3. ([simplify_fractions](#) => [simplify_products](#))
4. ([add_like_terms](#))

The hypothesis spaces learned by PMSI for the [Robot Planning](#) domain.

DQN #4 (lowest level)

1. ([attempt_to_place_x_on_y](#))
2. ([unstack_item_above_x_to_reach_x](#))
3. ([unstack_item_above_y_to_make_room_for_x](#))
4. ([update_innerese_world_representation](#))

DQN #3

1. (unstack_item_above_x_to_reach_x => attempt_to_place_x_on_y)
2. (unstack_item_above_y_to_make_room_for_x => attempt_to_place_x_on_y)
3. (unstack_item_above_y_to_make_room_for_x => unstack_item_above_x_to_reach_x)
4. (update_innerese_world_representation)

DQN #2

1. (unstack_item_above_y_to_make_room_for_x => unstack_item_above_x_to_reach_x => unstack_item_above_y_to_make_room_for_x => attempt_to_place_x_on_y)
2. (unstack_item_above_y_to_make_room_for_x => unstack_item_above_x_to_reach_x => unstack_item_above_x_to_reach_x => attempt_to_place_x_on_y)
3. (update_innerese_world_representation)

DQN #1 (top level)

1. (unstack_item_above_y_to_make_room_for_x => unstack_item_above_x_to_reach_x => unstack_item_above_y_to_make_room_for_x => attempt_to_place_x_on_y => unstack_item_above_y_to_make_room_for_x => unstack_item_above_x_to_reach_x)
2. (unstack_item_above_y_to_make_room_for_x => unstack_item_above_x_to_reach_x => unstack_item_above_x_to_reach_x => attempt_to_place_x_on_y)
3. (update_innerese_world_representation)