PWT Follow-Up Protocol: Testing the Boundaries of Prime-Indexed Scaling

Version: 2.0
Goal: To determine the precise transition point and stability of the p-DSI effect by testing higher-order prime constraints (Twin Primes) and small perturbations (±ϵ±ϵ) around prime scales.

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1. Experimental Conditions and Independent Variables (ΛΛ)

This experiment modifies the independent variable λλ to test the theory's structural limits. The core environment (Blocksworld RL) and all 6 dependent metrics remain identical to Protocol 1.1.

New Condition Set A: Prime Perturbation Testing

This set tests the stability of the ΦDΦD effect when the scaling factor λλ is slightly perturbed from a prime number.

Condition	Scaling Factors (ΛΛ)	Type	Hypothesis
Prime Core (ΛP5ΛP5)	{5}{5} (Baseline from P1.1)	Prime	Max ΦDΦD (Expect ~250+~250+)
Prime Minus Epsilon (ΛP−ϵΛP−ϵ)	{4.9,4.95,4.99} {4.9,4.95,4.99}	Slight Composite Shift	Gradual reduction in ΦDΦD
Prime Plus Epsilon (ΛP+ϵΛP+ϵ)	{5.01,5.05,5.1} {5.01,5.05,5.1}	Slight Composite Shift	Gradual reduction in ΦDΦD
Composite Core (ΛC4ΛC4)	{4}{4} (Baseline from P1.1)	Composite	Min ΦDΦD (Expect ~120~120)

New Condition Set B: Higher-Order Prime Structure (Twin Primes)

This set tests if "prime clustering" (twin primes) yields enhanced effects due to the close proximity of two fundamental scale constraints.

- **Twin Prime Condition (ΛTPΛTP):** Scale the network or learning rate using a pair of factors (λ1,λ2)(λ1,λ2) defined by two consecutive prime numbers separated by 22: {(5,7),(11,13),(17,19)}{(5,7),(11,13),(17,19)}.
    - **Architectural Test:** Use λ1λ1 for Layer 1 width and λ2λ2 for Layer 2 width.
    - **Temporal Test:** Use λ1λ1 for the forward pass period and λ2λ2 for the backward pass period.
- **Hypothesis:** ΛTPΛTP will result in **super-additive ΦDΦD values** (e.g., ΦD>270ΦD>270) due to the cooperative stabilization of scales.

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4. Modified Execution Protocol

1. **Train:** Run N=5N=5 instances for all 10 new conditions (Set A and Set B).

2. **Evaluate:** Run the standard evaluation battery to collect the 6 PWT metrics.
3. **Analysis:**
    - Plot ΦDΦD versus the λλ value for **Set A** to visualize the ϵϵ-sensitivity (transition function).
    - Compare the mean ΦDΦD of ΛTPΛTP against the mean ΦDΦD of the single primes ΛPΛP from Protocol 1.1 using a dedicated t-test to check for the super-additive effect.