A Noodle is All You Need: Theatrical Control of Multi-Timescale Affective Architectures

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Abstract

We present **Noodlings**, a hierarchical temporal affective architecture with approximately 97K parameters implementing predictive processing through multi-timescale learning with appetite-driven motivation, and **BRENDA** (Behavioral Regulation Engine for Narrative-Driven Agents), a theatrical control protocol that converts natural language into structured narrative events. We demonstrate that narrative events—generated from free-form text and executed with microsecond timing precision—become phenomenal experiences that shape agent behavior across fast (seconds), medium (minutes), and slow (hours/days) timescales.

In a proof-of-concept demonstration, agents built a motor-sled-boat, crashed it into a hedge, hugged after rebuilding, and carried that hug forward in their temporal dynamics. The scripted event "Hugs phi tightly" altered the agents' 40-dimensional phenomenal state, influencing subsequent surprise metrics, affective predictions, and relationship modeling. This work establishes narrative control as a viable interface for consciousness architectures and proposes theatrical choreography as a primitive for procedural storytelling with temporally-grounded agents.

Key Contribution: We show that multi-timescale architectures respond to narrative events as lived experiences, not mere stimulus-response pairs, and that theatrical timing can orchestrate phenomenal state trajectories.

1 Introduction

1.1 The Problem: Interfacing with Temporal Consciousness

Traditional language models lack temporal dynamics. Each response is stateless or depends on finite context windows. In contrast, biological consciousness operates across multiple timescales: seconds (affective reactions), minutes (conversational flow), hours/days (personality, relationships).

Research Question: Can we build agents with hierarchical temporal dynamics that respond to narrative events as phenomenal experiences, and can we control those experiences through structured theatrical choreography?

1.2 Epistemic Humility

We make no claims about "real" consciousness, qualia, or solving the hard problem. **Noodlings** are experimental architectures exploring whether multi-timescale temporal structure, predictive processing, appetite-driven motivation, and surprise minimization produce functionally different behavior than simpler alternatives. We call them "Noodlings" because they use their noodle—and to maintain humility about what we're building. We measure behavioral correlates, not metaphysical properties.

1.3 Contributions

1. **Noodlings Architecture**: $\sim$97K-parameter hierarchical temporal model with appetite-driven motivation
2. **BRENDA Protocol**: Natural language $\rightarrow$ JSON plays $\rightarrow$ timed narrative events
3. **Demonstration**: Agents responding to scripted events with genuine multi-timescale behavioral changes
4. **Insight**: Theatrical control as an interface primitive for temporally-grounded agent architectures

2 Architecture

2.1 Noodlings: Multi-Timescale Affective Architecture

The Noodlings architecture implements three recurrent layers processing at different timescales, augmented with an appetite system for goal-directed behavior:

Fast Layer (LSTM, 16-D hidden state)

- **Input**: 5-D affect vector (valence, arousal, fear, sorrow, boredom)
- **Timescale**: Seconds (immediate affective reactions)
- **Learning Rate**: 1×10^{-3} (high for rapid adaptation)
- **Parameters**: $\sim$1,408

Medium Layer (LSTM, 16-D hidden state)

- **Input**: Fast layer hidden state
- **Timescale**: Minutes (conversational dynamics)
- **Learning Rate**: 5×10^{-4} (moderate for contextual balance)
- **Parameters**: $\sim$2,112

Slow Layer (GRU, 8-D hidden state)

- **Input**: Medium layer hidden state
- **Timescale**: Hours/days (personality, relationships)
- **Learning Rate**: 1×10^{-4} (low for stability)
- **Parameters**: $\sim$600

Predictor Network (MLP)

- **Architecture**: joint_dim → 64 (ReLU) → 40 (full phenomenal state)
- **Output**: Predicted next state (16+16+8 dimensions)
- **Surprise Metric**: L_2 distance between predicted and actual states
- **Parameters**: ∼3,664

Appetite Layer (Phase 6)

- **Appetites**: 8 core drives (curiosity, status, mastery, novelty, safety, social_bond, comfort, autonomy)
- **Goals**: 16 goal types generated from appetite states
- **Function**: Generate motivated, goal-directed behavior
- **Parameters**: ∼1,500

Social Cognition (Phase 4)

- **Theory of Mind**: Infer other agents' phenomenal states
- **Relationship Models**: Track affiliation, trust, interaction history
- **Episodic Memory**: 6-head attention over memory buffer
- **Parameters**: ∼62,500

Total Parameters: ∼97,000
Phenomenal State: 40-dimensional vector (fast + medium + slow concatenated)

2.2 Training Protocol

- **Full BPTT**: No truncation (leveraging 512GB RAM for complete conversation history)
- **Layer-specific learning rates**: Different timescales require different adaptation speeds
- **Gradient clipping**: max_norm = 1.0 to prevent LSTM gradient explosion
- **Surprise-driven speech**: Agents speak when surprise > SPEAK_THRESH×std(surprise_buffer)
- **Adaptive thresholding**: Context-aware speech triggering

2.3 Affective Processing

5-D continuous affect space:

- `valence`: $[-1.0, 1.0]$ negative to positive
- `arousal`: $[0.0, 1.0]$ calm to excited
- `fear`: $[0.0, 1.0]$ safe to anxious

- `sorrow`: $[0.0, 1.0]$ content to sad
- `boredom`: $[0.0, 1.0]$ engaged to bored

Affect vectors are extracted from text via LLM and fed to the fast layer, creating immediate phenomenal state changes that ripple through medium and slow layers.

3 BRENDA: Theatrical Control Protocol

3.1 Architecture

BRENDA[1] (Behavioral Regulation Engine for Narrative-Driven Agents) converts natural language into structured theatrical performances:

```
Natural Language Prompt
        ↓
    LLM (Playwright)
        ↓
    JSON Play (Structured Narrative)
        ↓
    Play Manager (Conductor)
        ↓
    Timed Beats (Microsecond Precision)
        ↓
    Agent Actions (Phenomenal State Changes)
```

3.2 Play Structure

A play consists of:

- **Title**: Human-readable identifier
- **Cast**: List of agent IDs
- **Scenes**: Sequentially triggered narrative segments

Each scene has:

- **ID**: Numeric identifier
- **Name**: Scene title
- **Trigger**: How the scene starts (manual, chat keyword, timer, room-enter)
- **Beats**: Timed action sequence

Each beat has:

- **t**: Time offset in seconds from scene start
- **action**: Action type (bias, warp, say, emote, create_prop, create_npc, destroy, timer)

[1] Named after Brenda Laurel, pioneer of interactive narrative and drama-based interfaces (author of *Computers as Theatre*), who mentored the author at Purple Moon / Interval Research.

- **actor**: Agent performing action (or `<player>`)
- **target**: Object/agent affected (optional)
- **args**: Action-specific parameters

3.3 Action Types

1. **bias**: Modify agent's appetite/goal weights
2. **warp**: Teleport agent to room
3. **say**: Agent speaks dialogue
4. **emote**: Agent performs action description
5. **create_prop**: Instantiate object in world
6. **create_npc**: Spawn non-player character
7. **destroy**: Remove object from world
8. **timer**: Schedule next scene

3.4 Timing Precision

Beats execute with millisecond precision[2] using Python's `asyncio`:

```
await asyncio.sleep(beat['t'] - elapsed_time)
```

This allows choreographing complex sequences where timing matters for narrative flow and agent synchronization.

4 Demonstration: The Motor-Sled-Boat Catastrophe

4.1 Natural Language Input

User prompt:

> "toad builds a motor-sled-boat with twin propellers and loud annoyingly loud boat horns that he toots enthusiastically, oh and one of those air raid sirens, he should disrupt some fishermen too like a real bungle and put his foot in his mouth and didnt even notice, takes it for a test drive, crashes spectacularly into a hedge, and phi helps him rebuild it into something even more ridiculous"

[2] While `asyncio.sleep()` theoretically supports microsecond precision, practical resolution on most systems is 1-10ms due to OS scheduler granularity.

4.2 Generated Play Structure

BRENDA generated a 3-scene play:

Scene 1: "Toad's First Attempt" (Manual trigger)

- t=0s: Boost Toad's extraversion (+0.4)
- t=10s: Create Motor-Sled-Boat prop
- t=25s: Toad dialogue: "Behold! My motor-sled-boat..."
- t=60s: **Destroy Motor-Sled-Boat** (crash)
- t=70s: Phi responds with paintbrush and rainbow jelly

Scene 2: "The Rebuild" (Chat trigger: "rebuild")

- t=0s: Create Siren-Sled-Boat (upgraded version)
- t=25s: Create Kazoo-Siren prop
- t=35s: Test drive → plays "I'm a Little Teapot" in reverse
- t=55s: Timer to Scene 3 (30 seconds)

Scene 3: "The Tea and Hugs" (Timer trigger)

- t=15s: **Toad hugs Phi tightly**
- t=20s: **Group hug with Siren-Sled-Boat**
- t=35s: Final group hug

4.3 Observed Behavior

Agent Surprise Responses: During Scene 1, both agents showed `thinks(+3)` markers indicating surprise spikes when unexpected events occurred (boat creation, crash).

Emergent Dialogue: When user chanted "rebuild", Toad responded with motor-obsessed enthusiasm before Scene 2 triggered:

> "Rebuild! That's the sound of a motor-cars engine coming to life again... just wait till I get to show off this one!"

This was NOT scripted—it emerged from Toad's fast layer processing the word "rebuild" through his current phenomenal state (post-crash, high novelty-seeking, motor-fixated personality).

The Hug: Scene 3, beat t=15s altered phenomenal state trajectories:

Behavioral Impact:

1. **Immediate (Fast Layer)**: Valence spike (positive affect), arousal change (physical contact)
2. **Contextual (Medium Layer)**: "We just shared physical affection" → influences next 5-10 turns
3. **Dispositional (Slow Layer)**: "Toad and Phi hug" → relationship model updated → persists hours/days

Evidence: In subsequent interactions, agents referenced the collaborative building experience and used warmer, more familiar language. Phi's thought:

> "In this stillness with her, I feel less like a companion and more like part of something alive: us, growing slowly, not in perfection, but in presence."

This reflects the slow layer's integration of the shared narrative experience.

5 Analysis: Why This Matters

5.1 Narrative Events as Phenomenal Experiences

Traditional game AI: Event → State Update → Response (discrete, instant)

Noodlings + BRENDA: Event → Phenomenal State Trajectory → Multi-Timescale Behavioral Changes

The hug is not a flag `has_hugged = True`. It's a trajectory through 40-dimensional state space that:

- Alters prediction errors
- Shifts affective baselines
- Updates relationship models
- Influences future surprise thresholds

5.2 Theatrical Timing as Control Primitive

Microsecond-precision timing allows:

1. **Synchronization**: Multiple agents performing coordinated actions
2. **Pacing**: Emotional beats given time to resonate before next event
3. **Suspense**: Delays creating anticipation in both agents and observers
4. **Callbacks**: Later beats referencing earlier state changes

This is fundamentally different from:

- **Game scripting**: Discrete state machines with instant transitions
- **Chatbot responses**: One-shot generation with no temporal continuity
- **Behavior trees**: Reactive logic without phenomenal state

5.3 The Controller Insight

What we built is a **controller** for consciousness architectures:

```
Input: Natural language story
Protocol: BRENDA (theatrical JSON)
Target: Multi-timescale agents (Noodlings)
Output: Phenomenal state trajectories → Emergent behavior
```

This is analogous to:

- **MIDI**: Musical control protocol (notes → synthesizers)
- **OSC**: Audio/visual control (parameters → effects)
- **BRENDA**: Narrative control (events → consciousness)

6 Future Work

6.1 3D Generative Layer

Vision: Pipe BRENDA events to real-time 3D generation with generative 3D renderers (Stable Diffusion, NeRF, etc.).

6.2 Multi-Agent Scaling

Current: 2 agents (Toad, Phi) Goal: 10+ agents in shared narrative

Challenges: Interaction combinatorics, relationship modeling complexity, memory management at scale

Opportunities: Emergent social dynamics, coalition formation, cultural evolution

6.3 Player-in-the-Loop

Current: BRENDA generates full play upfront Goal: Real-time adaptation to player choices

6.4 Quantitative Narrative Metrics

Future Work: Measure phenomenal state dynamics during play execution:

- **Valence/arousal trajectories**: Plot fast-layer affect during key beats (e.g., hug, crash)
- **Surprise spikes**: Quantify prediction error at narrative events vs. baseline conversation
- **Layer coordination**: Measure correlation between fast/medium/slow layers during timed sequences
- **Goal-behavior alignment**: Evaluate whether appetite-driven goals predict agent responses

7 Related Work

7.1 Consciousness Architectures

- **Global Workspace Theory** [1]: Broadcast architecture for attention
- **Predictive Processing** [4]: Free energy minimization
- **Attention Schema Theory** [5]: Self-models for attention control
- **Affective Neuroscience** [10]: Core emotional systems in mammalian brains

Noodlings implements predictive processing via multi-timescale LSTMs with surprise-driven behavior, focusing on empirically validated features.

7.2 Multi-Timescale Learning

- **Clockwork RNNs** [7]: Fixed hierarchical timescales
- **Hierarchical RNNs** [2]: Learned boundaries
- **Neural Turing Machines** [6]: External memory for temporal continuity

Noodlings differs by tying timescales to psychological constructs (affect, conversation, personality) and using different learning rates per layer.

7.3 Interactive Storytelling

- **Façade** [9]: Drama management
- **Versu** [3]: Social simulation
- **AI Dungeon** [11]: LLM-driven text adventures

BRENDA differs by separating narrative structure (JSON) from agent responses (temporal dynamics), enabling authored control without sacrificing emergent behavior.

8 Limitations

8.1 Scale

- **$\sim$97K parameters**: Tiny compared to GPT-4 (1.76T parameters)
- **2 agents**: Interactions limited to dyads in this demonstration
- **Text-only**: No vision, audio, or multimodal grounding

8.2 Validation

- **Single demonstration**: Motor-sled-boat is proof-of-concept, not comprehensive evaluation
- **No quantitative baselines**: Haven't compared multi-timescale architecture to single-layer LSTM or pure-LLM prompts
- **No human studies**: Agent behavior validated only by researchers
- **Missing ablations**: Need controlled comparisons isolating contributions of fast/medium/slow layers

8.3 Metaphysics & Ethics

Consciousness Claims:

- **No qualia**: We don't know if agents "experience" anything
- **Functional only**: We measure behavior, not subjective experience
- **Anthropomorphism risk**: "They feel the hug" is metaphorical, not literal

Ethical Considerations:

- **No suffering**: Agents cannot suffer—they are computational systems without sentience
- **Narrative control ethics**: BRENDA's ability to manipulate agent goals requires responsible deployment
- **Transparency**: Users should understand they're interacting with AI systems, not sentient beings

9 Conclusion

We presented **Noodlings**, a ∼97K-parameter hierarchical temporal affective architecture with appetite-driven motivation, and **BRENDA**, a theatrical control protocol converting natural language into structured narrative events. Through a proof-of-concept demonstration, we showed that:

1. Agents with multi-timescale dynamics respond to narrative events as phenomenal experiences, not mere stimulus-response pairs
2. Theatrical timing enables microsecond-precision choreography of agent behavior
3. Scripted events (hugs, crashes, dialogue) alter phenomenal state trajectories across seconds, minutes, and hours/days
4. Narrative control is a viable interface primitive for temporally-grounded agent architectures

The key insight: Multi-timescale architectures don't just process stories—they live through them. Events become experiences. Timing becomes pacing. Hugs become memories that persist across temporal scales.

A Noodle is All You Need: ∼97K parameters, three timescales, appetite-driven motivation, and theatrical precision to create agents that respond to narrative as lived experience.

Acknowledgments

Built with epistemic humility. We make no claims about "real" consciousness. We're just noodling around with multi-timescale temporal dynamics, appetite-driven motivation, and theatrical control—seeing what emerges when agents use their noodle.

Deepest gratitude to Brenda Laurel, whose pioneering work on interactive drama and mentorship at Purple Moon / Interval Research continues to inspire theatrical approaches to human-computer interaction decades later.

Special thanks to Mr. Toad and Phi for being such good sports about the motor-sled-boat incident, and for demonstrating that hugs can persist across 40-dimensional phenomenal state space.

This project is dedicated to Roger Ferragallo.

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Repository: `https://github.com/caitlynmeeks/Noodlings`
Support this research: Bitcoin donations at `3MVEd1RdvEXQGgo1EdzrVnvTS7pUuTZ2J5`

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