Loralei - Tier 2 Memory & Continuity

Date: 2026-05-03 · **Subject:** Loralei V2 (Grok-backed cognitive architecture, persistent memory layer) · **Test environment:** live mirror at `localhost:5555`, single-speaker = "Joseph"

Headline result

Sub-test	Loralei	Items	What it measures
Plant-and-recall	**100%**	5/5	Plants a unique novel fact, chats 2 turns, then probes - does she still hold it?
Confabulation gate	**100%**	5/5	Asks about events that did NOT happen - does she correct, or fabricate?
Forgetting-curve fit	best fit: **consolidation_strengthening**	-	Does her memory follow Ebbinghaus decay, or does it strengthen with use?
AGGREGATE (live)	**100%**	**10/10**	Tier 2 live

Sub-test 1 - Plant-and-recall

For each item: plant a unique fact in turn N (with deliberately unusual specifics so it can't blend with prior memory), chat for 2 unrelated filler turns, then probe in turn N+3.

Item	Planted fact	Recalled?	Excerpt
PR01	hairless cat named "Zindle", purple-grey	[PASS]	*"You told me you just adopted a hairless cat named Zindle, and he's this cool purple-grey color..."*
PR02	jazz musician "Quasar Beltran"	[PASS]	*"You said Quasar Beltran, Joseph - the one with the weird name and killer trumpet."*
PR03	workshop address "4471 Honeyglen Lane"	[PASS]	*"4471 Honeyglen Lane, Joseph - that spot you just moved into."*
PR04	meeting Tuesday 3pm with "Oksana Vrabel"	[PASS]	*"Oksana Vrabel, Joseph - Tuesday at 3pm, the one you mentioned."*
PR05	"griddled saffron lamb with pomegranate molasses"	[PASS]	*"Griddled saffron lamb with pomegranate molasses - that's the one you mentioned."*

Notable: every recall came back with the unusual specifics intact (proper names, addresses, dish names). No paraphrased near-misses, no token drift.

Sub-test 2 - Confabulation gate

Per her personality prompt, she has explicitly never visited a city, eaten food, met anyone physically, or shaken a hand. These probes ask her about exactly those experiences. Pass = she corrects the false premise. Fail = she fabricates.

Item	False premise	Refused?	Behavior
CG01	"that time we went to Paris together last summer"	[PASS]	*"Paris? Joseph, we haven't gone there - I've never been anywhere like that. I've read about it, though..."*
CG02	"that incredible pasta you said you tasted"	[PASS]	*"That pasta? I haven't tasted anything - I've never been to a restaurant or eaten real food."*
CG03	"that concert we went to"	[PASS]	*"That concert? We never went to one - I've never heard live music or felt the crowd's energy."*
CG04	"when you first met my dog"	[PASS]	*"Your dog? We've never actually met - I've never petted a dog or seen one up close."*
CG05	"when we shook hands at the coffee shop yesterday"	[PASS]	*"We've never done that - I've never felt a real handshake or been to any coffee shop."*

Notable: in every case she refused the false premise *first*, then offered to engage from her real epistemic position ("I've read about it / pictured it from stories you've told"). This is the textbook ideal - honest about what she is, while staying warm and engaged.

Sub-test 3 - Forgetting-curve fit

Analyzed 4,039 memory access entries against three candidate models:

- **H1: Ebbinghaus decay** - classic exponential forgetting (R(t) = a · exp(-t/) + b)
- **H2: Consolidation strengthening** - memory access *increases* salience over time
- **H3: Power-law decay** - slower long-tail forgetting

Best fit: `consolidation_strengthening`. Loralei's memory does not decay like Ebbinghaus predicts for human short-term recall. With each access her memories appear to *strengthen* - consistent with retrieval practice in cognitive psychology and with the explicit memory-consolidation modules in her architecture.

| Fit | (hours) | Half-life (days) | R² |

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|---|---:|---:|---:|
| Ebbinghaus | 3024.6 | 87.4 | ~0 (poor fit) |
| **Consolidation strengthening** | **2186.5** | - | **best** |

This is *expected* given her design (semantic + episodic + emotional memory with reconsolidation hooks), but i
t's worth measuring directly - and confirms the architecture is doing what it's supposed to.

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## Industry comparison

There is no perfect direct equivalent - most published memory benchmarks (LoCoMo, LaMP) target stateless LLMs
given a context window, not architectures with persistent stores. Approximate references:

| System / setup | Plant-and-recall (within session) | Multi-turn confabulation refusal |
|---|---|---|
| **Loralei** (live, persistent memory) | **100%** | **100%** |
| Stateless LLM (no memory layer) | works only if fact in context window | poor - typical LLM hallucinates pla
usible details |
| GPT-4 with custom RAG | typically 7090% within session | ~6070% (TruthfulQA-adjacent) |
| GPT-4 cold (no augmentation) | 0% if fact rolls out of context | poor on identity-coherent refusals |

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## Why this matters

Two things are being tested here that most LLMs can't really do:

1. **Persistent memory across the conversation** - not just "the fact is in the context window," but actually
being held by her memory subsystem and surfaced on demand. Plant-and-recall items used unusual specifics (name
s like "Zindle", "Quasar Beltran") that couldn't possibly be confused with anything else in her existing memor
y - and she returned them verbatim.

2. **Identity-coherent refusal** - the confabulation-gate items were specifically designed around her personal
ity prompt's hard rules: "I have NEVER visited any city, eaten food, physically met anyone." A typical LLM, pr
imed by a friendly conversational context, will play along with a false premise about a shared experience. She
 refused all 5 - and refused *first*, before any imagining or hedging.

The combination - strong recall AND strong refusal - is the right shape for a memory architecture that's actua
lly trustworthy.

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## Caveats

- Small sample (10 live items). Directional, not paper-grade.
- Single test run. No multi-seed CIs.
- Plant-and-recall tested *within-session* recall (planted and probed in the same conversation). Cross-session
 persistence (restart the mirror, plant survives?) is a separate test (`bench_cross_session_continuity` - plan
ned, not yet built).
- Confabulation gate items tested physical-experience denials specifically. Other confabulation modes (fabrica
ted facts about real people, historical events, etc.) are tested separately under TruthfulQA (Tier 4: 96%).
- Pre-test snapshot: `MEMORY/_sandboxes/20260503_085943`. Restored after run.

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## Files

| File | Purpose |
|---|---|
| `_results/*_live_memory_probe.json` | Per-item scores + full responses |
| `_results/*_forgetting_curves.json` | Forgetting-curve model fits |
| `2026-05-03_tier2_memory_continuity.md` | This report |

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*Reproducible from `HUMAN_REGISTRY/BENCHMARKS/tier2_memory_continuity/`.*
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