Analysis Report: Impact of Heartbeat-to-Interval Transition on Avatar Embodiment Metrics

Context of the Transition

The data infrastructure is undergoing a key transition:

Deprecation of the heartbeat table in favor of a more consolidated and coarse-grained **intervals table** as the default source for session tracking.

What Is Changing?

- **Previous Source**: heartbeat – collected **per-minute pings**, tracking detailed in-session behaviors, avatar presence, and transitions.
- **New Source**: intervals – tracks **session-level metadata** with only **start_time** and **end_time**, capturing high-level presence but **not granular intra-session events**.

The transition is platform-wide and affects **all downstream systems** consuming heartbeat-based data, including **avatar embodiment metrics** used by analytics, personalization, engagement scoring, and operational dashboards.

Areas of Analysis: Avatar Embodiment Metric Sensitivity

This section outlines the key changes expected in avatar-related embodiment metrics due to the shift from heartbeat to intervals.

1. Loss of Granularity in Avatar Presence Tracking

- The heartbeat table reported **avatar_id** every minute.
- In contrast, intervals captures avatar_id only at session start or end (if at all).

Effect:

Mid-session avatar switches, experimentation, and drop-offs cannot be detected using interval data. This affects analysis of avatar experimentation, personalization tuning, and per-avatar engagement heatmaps.

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2. Absence of Ping-Based Continuity Checks

- Heartbeat-based logic inferred **user confidence and embodiment quality** through consistent ping intervals.
- Intervals has no intra-session granularity to distinguish between a stable vs interrupted session.

Effect:

Embodiment scoring, previously graded on stability, becomes binary (present or not). This impacts trust in duration metrics and could inflate or distort session quality indicators.

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3. Inability to Detect Mid-Session State Transitions

- In the heartbeat model, one could observe state transitions like:
    - Going from default avatar → custom avatar,
    - Switching avatar forms (e.g., human → fantastical),
    - Losing tracking due to device/connection issues.
- The intervals table lacks visibility into these transitions.

Effect:

Complex behavioral sequences and avatar-switching trends will no longer be traceable. Time-series-based behavioral segmentation loses accuracy.

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4. False Attribution Risks for Embodiment

Heartbeat's minute-level granularity allowed filters like:

- Minimum duration thresholds,
- Sustained tracking checks (presence of regular pings),
- Avatar lock-in validation.

Intervals only records a session as a whole.

Effect:

Sessions where users never actively engaged (e.g., launched app and exited) might now be misclassified as embodied sessions if an avatar_id is present at any point. This leads to over-attribution of avatar presence.

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5. No Detection of Concurrent Usage Conflicts

- Heartbeat allowed detection of conflicting sessions with overlapping timestamps using the same avatar_id (from different devices or users).
- Intervals lacks the timestamp density to flag these overlaps.

Effect:

Data quality checks for avatar sharing, duplicate embodiment, or impersonation will weaken. Trust in uniqueness of embodiment instances will reduce.

Schema-Level Comparison (Narrative Form)

- The **heartbeat table** effectively functioned like a continuous stream of presence data per user-avatar combination, allowing micro-level session reconstruction.
- The **intervals table** provides a macro-level summary per session but lacks:
    - Per-minute resolution
    - In-session context changes
    - Avatar engagement fidelity

Many derived metrics in the **fct_avatar_embodiment** and **datelist_hz_avatar_embodiment** tables were dependent on heartbeat's granular structure.

These include:

- Avatar MAU per persona
- Avatar confidence scores
- Embodiment dropout detection
- Avatar fatigue tracking
- Time-spent per avatar with quality gates

Affected Use Cases

The following analytical areas are likely to be **sensitive** to the transition:

- **Avatar Popularity Metrics**: Ranking of avatars by unique user engagement may be distorted.
- **Embodiment Segmentation**: Binning users by depth/quality of embodiment becomes unreliable.
- **New Avatar Adoption**: Detection of experimentation and switches weakens.
- **Concurrent Embodiment Conflicts**: Duplicate tracking becomes untraceable.
- **MAU Attribution**: Overlap between presence and embodiment may cause MAU inflation.

Benefits of the Transition (From a Systemic Perspective)

While this report does not endorse the transition, it recognizes some intended benefits from an infrastructure and platform standpoint:

- **Simplified data model**: The intervals table standardizes session tracking across surfaces.
- **Reduced storage costs**: Minute-level pings are heavy to store and process; intervals are lean.
- **Lower latency**: Intervals can be used in near real-time dashboards with minimal aggregation.
- **Unified ingestion**: Reduces ingestion pipelines to maintain (heartbeat often required bespoke logic).

Outstanding Clarifications / Risks

- Is there a plan to augment intervals with intermediate event tracking (e.g., via an events table)?
- Will avatar_id in intervals reflect the avatar at session end, start, or snapshot?
- Are there any fallback mechanisms being retained for critical embodiment metrics?
- How will data consumers be notified of attribution shifts or definition changes?

Summary

The heartbeat-to-interval transition reflects a shift in philosophy from **high-fidelity behavioral tracking** to **summary-level session modeling**. This has considerable consequences for avatar-specific embodiment metrics, particularly those relying on continuity, granularity, and intra-session dynamics.

This report focuses purely on documenting the **nature of the change**, **expected data-level impacts**, and **use case sensitivities** — without proposing remediation or implementation paths.

Further analysis and validation are recommended to assess the statistical deviation in embodiment metrics across overlapping periods of heartbeat and intervals availability.