# **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.

### **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.

### **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.

### **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.

### **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

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## **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?

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## **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.