Real-Time Behavioral Personalization (RTBP)

RTBP is a real-time personalization engine that dynamically adapts content, workflows, interfaces, and interventions within milliseconds based on continuously inferred user behavior, intent, emotional state, and cognitive load.

Unlike traditional personalization systems that rely on static profiles or batch updates, RTBP operates as a live behavioral control system, responding during an interaction rather than after one. .

Dr. Scott M. Martin, Inventor, Architect

Core Design Principle

Personalization is a control loop, not a recommendation.

RTBP continuously:

- Observes behavior
- Infers latent state
- Selects an optimal action
- Measures impact
- Adapts immediately

Behavioral Signal Ingestion Layer

RTBP ingests high-frequency, multi-modal behavioral signals in real time.

Behavioral Signals:

- Click paths, scroll depth, dwell time
- Task switching, retries, abandonment
- Typing speed, corrections, pauses
- Voice pace, tone, hesitation (if available)

Temporal & Interaction Signals:

- Sequence order of actions
- Time-between-events
- Acceleration / deceleration patterns
- Repetition or looping behavior

Contextual Modifiers:

- Device type and modality
- Environmental constraints (time pressure, noise, interruptions)
- Workflow stage and task complexity

Signals are processed as streams, not as events.

Real-Time State & Intent Inference Engine

At the heart of RTBP is a streaming inference engine that estimates latent human states

Inferred States (Continuously Updated)
- Intent: goal-driven, exploratory, blocked, disengaging
- Urgency: low → critical
- Sentiment: positive, neutral, frustrated
- Cognitive Load: under-utilized, optimal, overloaded
- Confidence / Uncertainty
- Error Likelihood

Modeling Approach
- Sliding-window time-series models
- Bayesian belief updates per user
- Ensemble inference (LLM + statistical + ML)
- Confidence-weighted state vectors

User are represented as a live state vector updated every interaction.

Personalization Decision Engine

RTBP selects next-best personalization actions in real time

Action Categories:

Content Adaptation
- Simplify, summarize, expand
- Change modality (text → visual → voice)

Interface Adaptation
- Reduce UI density
- Highlight critical paths
- Change pacing or interaction style

Workflow Adaptation
- Skip steps
- Defer non-critical tasks
- Reorder actions

Intervention
- Just-in-time guidance
- Confirmation prompts
- Human escalation

Decision Logic:
- Utility-based optimization
- Policy and compliance constraints
- User-specific reward functions
- Exploration vs exploitation balancing

Two users performing the same task may receive opposite adaptations

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Millisecond-Level Execution & Orchestration

RTBP executes adaptations across live interaction surfaces:

- Web & mobile UI
- Conversational interfaces
- Dashboards & notifications
- Embedded tools and copilots

Actions are:

- Reversible
- Context-scoped
- Continuously re-evaluated

Hyper-Personalization can be applied, rolled back, or adjusted mid-interaction

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Continuous Feedback & Learning Loop

RTBP measures micro-outcomes, not just success/failure.

Feedback Signals:

- Task completion speed
- Error reduction
- Drop-off prevention
- Reduced hesitation or rework
- User overrides or rejections

Learning Mechanisms:

- Online reinforcement learning
- Per-user adaptation curves
- Cross-user pattern extraction
- Drift detection and recalibration

Learning occurs:

- In-session
- Across sessions
- Across similar users (without disclosing identities)

Reference Architecture

Behavioral Signal Streams -

- Interaction Events
- Temporal Metrics
- Context Modifiers

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Real-Time State Engine -
- Feature Extraction
- Sliding Window Analysis

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Intent & Cognitive State Inference -
- Intent Classification
- Sentiment & Load Estimation
- Confidence Scoring

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Personalization Decision Engine -
- Next-Best-Action Selection
- Policy & Risk Constraints

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Execution Layer
- UI / UX Adaptation -
- Content & Workflow Changes

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Outcome Measurement -
- Micro-Feedback Signals
- Reinforcement Updates

Patent-Relevant

RTBP is not:
- A recommender system
- A rules engine
- A static personalization layer

RTBP is:
- A real-time behavioral control system
- Cognitive-load-aware personalization
- Streaming inference of latent human state
- Millisecond adaptation within live interactions

Sample Example Claim:

A system and method for dynamically modifying user interfaces, content, and workflows in real-time based on continuously inferred user intent, emotional states, and cognitive load derived from streaming behavioral signals.
