Filter-Flash Functor for Subjective Phenomena

The Filter-Flash Functor (F³) is a bidirectional model within the OBINexus Bayesian Infrastructure, processing inputs (A) (sensory or informational data) and (B) (constraints, including cultural priors and protective barrier parameters) to produce refined ((A')) and immediate ((A'')) outputs. To address love and hate, we extend the functor to model subjective experiences by incorporating **semantic embeddings** and **contextual priors**, aligning with the *BIRTH* simulation's state machine and Okpala's consciousness model.

1. Mathematical Framework

1.1. Category-Theoretic Definition

The functor operates in a category $\mathcal{C}$:

- **Objects**: Pairs (A, B), where $A \in \mathcal{S}$ (state space, e.g., sensory inputs, emotional signals) and $B \in \mathcal{B}$ (constraint space, e.g., cultural priors, emotional context).

- **Morphisms**: Transformations (e.g., filtering, flashing) between states. $$ F: \mathcal{C} \to \mathcal{C} \times \mathcal{C}, \quad F(A, B) \mapsto (F.filter(A, B), F.flash(A, B)) $$

- **Functoriality**: Preserves composition and identity, ensuring consistent state transitions.

  #### 1.2. Probabilistic Model

  To handle subjective phenomena, we use a Bayesian framework with semantic embeddings:

- (A): Input state, now including emotional signals (e.g., neural patterns associated with love/hate).

- (B): Constraints, extended to include: $$ B = \left\{ \text{cultural\_priors}: P(\text{emotions} | \text{culture}), \text{linguistic\_context}: P(\text{terms} | \text{emotion}, \text{culture}), \text{subjective\_context}: P(\text{emotion} | \text{individual}), \text{protective\_barrier}: {\text{threshold} = T} \right\} $$

- **Semantic Embeddings**: Emotions like love and hate are represented as vectors in a high-dimensional semantic space $\mathcal{E}$, capturing verb-noun duality and contextual ambiguity (e.g., word2vec or BERT embeddings).

  #### 1.3. Filter Operation

  The filter refines emotional inputs into specific, context-dependent interpretations: $$ F.filter(A, B) = A', \quad P(A' | A, B) = \frac{P(A | A', B) \cdot P(A' | B)}{P(A | B)} $$

- (A'): Refined emotional state (e.g., "hate as a verb directed at a person").

- **Example**: For (A = \text{"I feel intense emotion toward you"}), (B) (including subjective context) refines to (A' = \text{"hate as rejection"}).

1.4. Flash Operation

The flash captures immediate emotional categorization: [F.flash(A, B) = A'', \quad A'' = \arg\max_{a'' \in \mathcal{E}} P(a'' | A, B)]

- (A''): Immediate category (e.g., "negative emotion" for hate).

- **Example**: For the same input, (F.flash) outputs (A'' = \text{"hate"}), recognizing the broad emotional category.

1.5. Composite Operation

The composite integrates both: [F.working.flashfilter(A, B) = (A', A''), \quad P(A', A'' | A, B) = P(A' | A, B) \cdot P(A'' | A, A', B)]

- **Example**: Outputs ((\text{"hate as rejection"}, \text{"negative emotion"})), capturing both specific interpretation and broad category.

1.6. Adjoint Relationship

The bidirectional relationship is an adjoint functor pair:

- **Projection**: (\pi: A'' \to A'), mapping a category (e.g., "negative emotion") to a specific instance (e.g., "hate as rejection").

- **Injection**: (\iota: A' \to A''), embedding a specific instance into its category.

- **Adjointness**: (\pi \circ \iota = id_{A'}), ensuring information preservation.

2. Modeling Love and Hate

Love and hate are ambiguous, context-dependent phenomena with verb-noun duality:

- **Verb**: Actions (e.g., "I love you" as an expression, "I hate you" as rejection).

- **Noun**: States (e.g., "love is warmth," "hate is anger").

- **Subjectivity**: Varies by individual due to genetic, environmental, and cultural factors, as noted in *BIRTH* (e.g., warm water felt differently by Emma).

2.1. Semantic Representation

- Represent love and hate as vectors in $\mathcal{E}$: $$\text{love} = \vec{v}_{\text{love}}, \quad \text{hate} = \vec{v}_{\text{hate}}$$ where $\vec{v}_{\text{love}}, \vec{v}_{\text{hate}} \in \mathbb{R}^d$ (e.g., $d = 300$ for word2vec).

- **Contextual Modulation**: B adjusts embeddings based on:

  - **Cultural Priors**: $P(\text{love} \mid \text{Igbo culture})$ emphasizes communal bonding.

  - **Subjective Context**: $P(\text{hate} \mid \text{individual}_i)$ varies by personal experience.

  - **Linguistic Context**: $P(\text{"love" as verb} \mid \text{sentence})$ distinguishes verb-noun roles.

2.2. Filter Operation for Love/Hate

- **Input**: $A = \text{"I feel intense emotion toward you"}$.

- **Constraints**: $B = \{\text{cultural\_priors}: P(\text{love} = 0.6, \text{hate} = 0.4), \text{subjective\_context}: P(\text{hate} \mid \text{person}_i = 0.7), \text{linguistic\_context}: P(\text{verb} = 0.8)\}$.

- **Output**: $A' = \text{"hate as verbal rejection"}$, computed via: $$P(\text{hate as verb} \mid A, B) = \frac{P(A \mid \text{hate as verb}, B) \cdot P(\text{hate as verb} \mid B)}{P(A \mid B)}$$

- **Process**: The filter refines the ambiguous emotion by considering the individual's history (e.g., past conflicts) and linguistic cues (e.g., verb usage).

2.3. Flash Operation for Love/Hate

- **Output**: $A'' = \text{"negative emotion"}$, via: $$A'' = \arg\max_{a'' \in \{\text{positive}, \text{negative}\}} P(a'' \mid A, B)$$

- **Process**: The flash immediately categorizes the emotion as positive (love) or negative (hate), based on broad contextual cues.

2.4. Composite Operation

- **Output**: $(\text{"hate as verbal rejection"}, \text{"negative emotion"})$.

- **Visualization in Simulation**: A cell transitions from black (unconscious, raw emotional signal) to blue (subconscious, recognizing emotion type) to green (conscious, specific interpretation).

3. Addressing the Hard Problem

The hard problem—why subjective experiences like love or hate arise—is modeled by:

- **Information Field**: In *BIRTH*, the unconscious state accesses a universal knowledge field, including emotional prototypes. The functor's flash operation captures the initial "feeling" of love/hate as a raw, subjective experience.

- **Protective Barrier**: Filters the overwhelming field into specific experiences (e.g., "love as warmth"), explaining why subjective experiences are context-dependent.

- **Subjective Variability**: The *BIRTH* note about differing experiences (e.g., warm water felt as hot or cold) is modeled by individual-specific priors in (B), reflecting genetic or environmental influences.

4. Addressing the Easy Problem

The easy problem—modeling cognitive mechanisms—is handled by:

- **State Machine**: The *BIRTH* simulation's black-blue-green transitions represent computational processes of attention and classification.

- **Functor Operations**: (F.filter) computes structured interpretations (e.g., "hate as verb"), while (F.flash) provides immediate categorizations, enabling objective processing.

5. Defining Love and Hate

- **Computational Definition**:

  - *Love*: A vector $(\vec{v}_{\text{love}})$ with high positive valence (e.g., warmth, bonding), modulated by (B): $[P(\text{love} \mid A, B) \propto \exp(\text{cosine\_similarity}(\vec{v}_{\text{love}}, \vec{A}) \cdot P(\text{love} \mid B))]$
  - **Hate**: A vector $(\vec{v}_{\text{hate}})$ with high negative valence (e.g., rejection, anger), similarly modulated.

- **Verb-Noun Duality**:

  - **Verb**: Modeled as an action in the linguistic context, e.g., $(P(\text{"love" as verb} \mid \text{sentence}, B))$.
  - **Noun**: Modeled as a state in the semantic space, e.g., $(P(\text{love as state} \mid \text{context}, B))$.

- **Contextual Ambiguity**: Resolved by (B), which adjusts priors based on individual and cultural factors (e.g., love in Igbo culture emphasizes community).

6. Simulation Integration

The *BIRTH* simulation visualizes these processes:

- **Black Cells (Unconscious)**: Access the raw emotional field (love/hate as unfiltered signals).

- **Blue Cells (Subconscious)**: (F.flash) categorizes emotions (e.g., "positive emotion" for love).

- **Green Cells (Conscious)**: (F.filter) refines into specific interpretations (e.g., "love as bonding").

- **Transitions**: Driven by the functor, with barrier strength increasing to filter emotions, reducing ambiguity. **Example Implementation**:

```python
import numpy as np
from enum import Enum
class State(Enum):
UNCONSCIOUS = "black"
SUBCONSCIOUS = "blue"
CONSCIOUS = "green"
class ConsciousnessSimulation:
def __init__(self, width, height, speed_ms=160):
self.grid = [[State.UNCONSCIOUS for _ in range(width)] for _ in range(height)]
self.barrier_strength = 0.5
self.emotion_space = {"love": np.array([0.8, 0.2]), "hate": np.array([-0.8, 0.2])}
def bayesian_update(self, A, B):
# F.filter: Refine emotional input
emotion = A["emotion"]
likelihood = np.exp(np.dot(self.emotion_space[emotion], B["subjective_context"]))
prior = B["cultural_priors"][emotion]
evidence = sum(np.exp(np.dot(self.emotion_space[e], B["subjective_context"])) *
B["cultural_priors"][e] for e in self.emotion_space)
posterior = likelihood * prior / evidence
return State.CONSCIOUS if posterior > 0.7 else State.SUBCONSCIOUS
def map_estimate(self, A, B):
# F.flash: Immediate emotional category
valence = np.sign(np.dot(self.emotion_space[A["emotion"]],
B["subjective_context"]))
return State.SUBCONSCIOUS if valence > 0 else State.CONSCIOUS
def update(self):
B = {"cultural_priors": {"love": 0.6, "hate": 0.4}, "subjective_context":
np.array([0.7, 0.3])}
for i in range(len(self.grid)):
for j in range(len(self.grid[0])):
A = {"emotion": np.random.choice(["love", "hate"])}
self.grid[i][j] = self.bayesian_update(A, B)
# Example usage
sim = ConsciousnessSimulation(10, 10)
sim.update()
```

Addressing Subjective Variability

- **Person-to-Person Differences**: The *BIRTH* note about warm water feeling hot or cold is modeled by individual-specific priors in (B). For example, (P(\text{hate} | \text{person}_i)) varies based on past experiences.
- **Experiential Context**: The functor uses (B[\text{subjective_context}]) to modulate emotional interpretations, capturing why one person's "love" feels like another's "hate."
- **Simulation Visualization**: Cells transitioning to green with different emotional labels (e.g., "love" vs. "hate") reflect subjective variability.

Conclusion

The Filter-Flash Functor robustly addresses both the hard problem (subjective experience of love/hate via flash's immediate recognition and the information field) and the easy problem (objective classification via filter's refinement). By incorporating semantic embeddings and contextual priors, it models the verb-noun duality and ambiguity of love and hate, aligning with the *BIRTH* simulation's state machine. The framework captures person-to-person variability through individual-specific priors, ensuring a culturally grounded, human-centric approach per OBINexus principles.