The Impact of Facial Expression and Head Orientation on Personality Perception

Melike Kara(22203094)
Supervisor: Uğur Güdükbay

1. Introduction

Why Do Facial Expressions and Head Pose Matter for Personality Perception?

Motivation

- People rapidly form personality impressions from non-verbal cues such as facial expressions and head orientation.
- These impressions play a crucial role in social interaction, trust, and communication.
- With the rise of video-based communication, virtual humans, and neural rendering, understanding these cues has become increasingly important.

What Prior Work Shows

1. Prior research in social computing and affective computing shows that facial expressions, gaze, and head motion play a central role in how personality is perceived in video-based interactions.

2. Several studies demonstrate that personality traits—particularly Extraversion—can be predicted from facial expressions in conversational videos and vlogs. These works establish strong correlations between non-verbal behavior and perceived personality. However, these approaches are primarily observational:
   - they analyze naturally occurring videos
   - multiple factors (identity, speech content, expression, pose) vary simultaneously
   - causal interpretation is therefore limited

3. As a result, it remains unclear which specific non-verbal cues actually drive changes in personality perception, and to what extent they do so independently.

2.1 Related Works

Personality Perception from Facial Behavior

- Cognitive neuroscience shows that the human visual system processes static facial features (identity) separately from **dynamic cues** such as facial expression and head pose, using specialized neural pathways.
- Research in social perception demonstrates that:
  - Facial appearance and expression lead to systematic **Big Five** personality impressions
  - These impressions **emerge rapidly and consistently**, even without linguistic or biographical information
- According to the 2D model of face evaluation, personality impressions are largely organized around:
  - Valence (intentions, trustworthiness)
  - Dominance (power, physical capability)
- Dynamic nonverbal cues play a critical role:
  - Facial motion and head orientation influence perceived personality
  - Even neutral faces can c**onvey different social meanings depending on orientation**
- Personality perception is strongly shaped by dynamic facial cues, not only static facial appearance.

2.2 Related Works

Neural Talking-Heads and Face Reenactment

Neural Talking-Heads & Controlled Face Reenactment

- Recent advances in neural talking-head synthesis and face reenactment enable:
  - identity-preserving facial animation
  - **motion transfer** driven by audio or source video
  - realistic expression and head pose control
- Modern approaches typically:
  - disentangle identity appearance and facial motion in latent space
  - rely on unsupervised keypoints, local transforms, or dense motion fields
  - ensure **temporal coherence** and **expressive realism**
- Recent reaearchs increasingly emphasize social interaction:
  - Interactive talking–listening behaviors
  - Socially meaningful nonverbal cues in conversational settings

2.2 Related Works

Neural Talking-Heads and Face Reenactment

Limitation of Prior Work

Most prior systems:

- vary **multiple cues** simultaneously (expression, pose, audio, identity)

This makes it difficult to determine:

- whether perceived personality differences arise from
  - facial motion itself
  - dentity or linguistic content
  - or synthesis artifacts

Our Contribution

We adopt a controlled, ceteris-paribus design:

- fixed identity, audio, lighting, background, and duration
- isolated manipulation of facial expression and head orientation

Our work aim to establish causal links between isolated nonverbal cues and personality perception.

→ 3.Stimuli Generation

→ Base Identity

- A **single identity** is used throughout the study
- Reference images:
  - **neutral** facial expression, uniform lighting, head-only portrait views (frontal and left)
- Identity images selected from **CMU Multi-PIE**
  - controlled capture conditions
  - consistent background and illumination

Using a single identity sacrifices generalizability but provides a **clean experimental setup**, allowing perceptual differences to be attributed directly to dynamic nonverbal cues rather than static facial appearance.

→ 3.Stimuli Generation

→ Driving Videos & Emotion Selection

- Facial motion sourced from **RAVDESS**:
  - professionally acted emotional speech
  - natural **facial motion** and head dynamics
- **Audio removed** to eliminate emotional tone of voice
- Clips are around 3-4 seconds
- Four emotional expresions selected:
  - Anger, Happiness, Sadness, Surprise
- Driving clips manually chosen to ensure:
  - **clear emotional dominance**
  - comparable duration and **expressive intensity**

3.Stimuli Generation

- Neural Reenactment
  - Talking-head videos generated using **LivePortrait**
  - Model disentangles:
    - identity-specific appearance
    - facial expression and head orientation
  - Motion transfer achieved via:
    - dense motion fields
    - implicit keypoints
  - High-fidelity reenactment minimizes:
    - expression smoothing
    - rendering artifacts
    - uncanny valley effects

Design Choice:

Perceived personality should be driven by social cues, not synthesis artifacts.

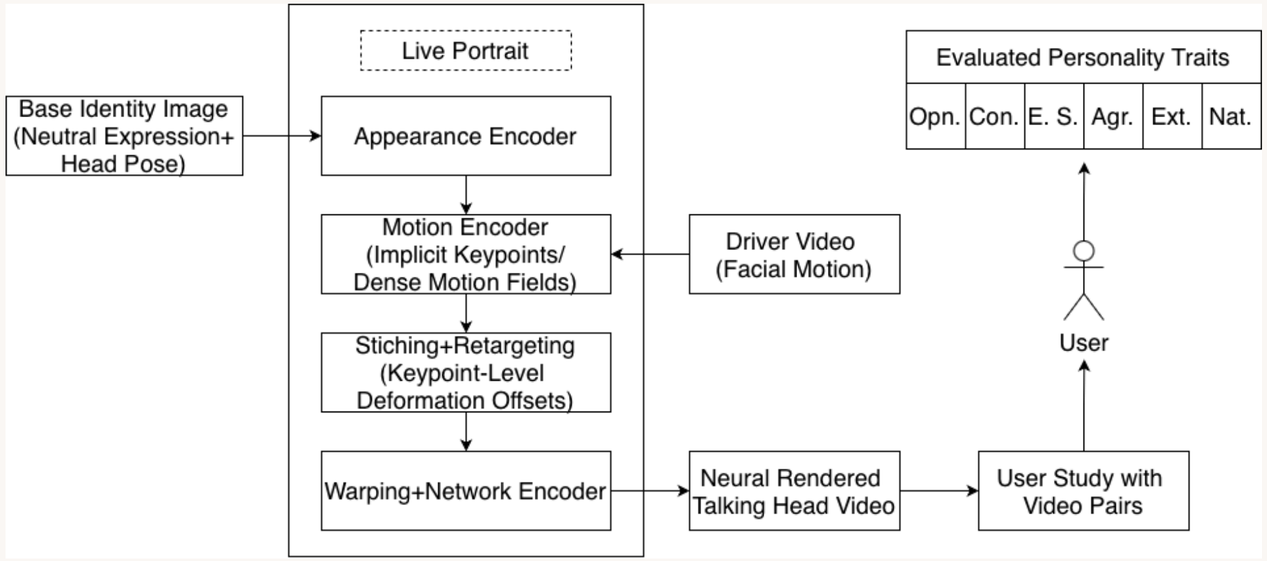


Fig. 1. Overview of the neural reenactment pipeline based on LivePortrait.

3.Stimuli Generation

Pair Construction (Ceteris Paribus)

From 8 base conditions, we construct 10 comparison pairs:

- Same emotion, different head pose (4 pairs)
  - frontal vs. left-facing
  - isolates head orientation
- Different emotion, same head pose (6 pairs)
  - frontal view only
  - isolates facial expression
- Presentation controls:
  - randomized pair order
  - randomized left–right placement

Outcome:

Each comparison isolates one visual factor at a time, enabling interpretation.

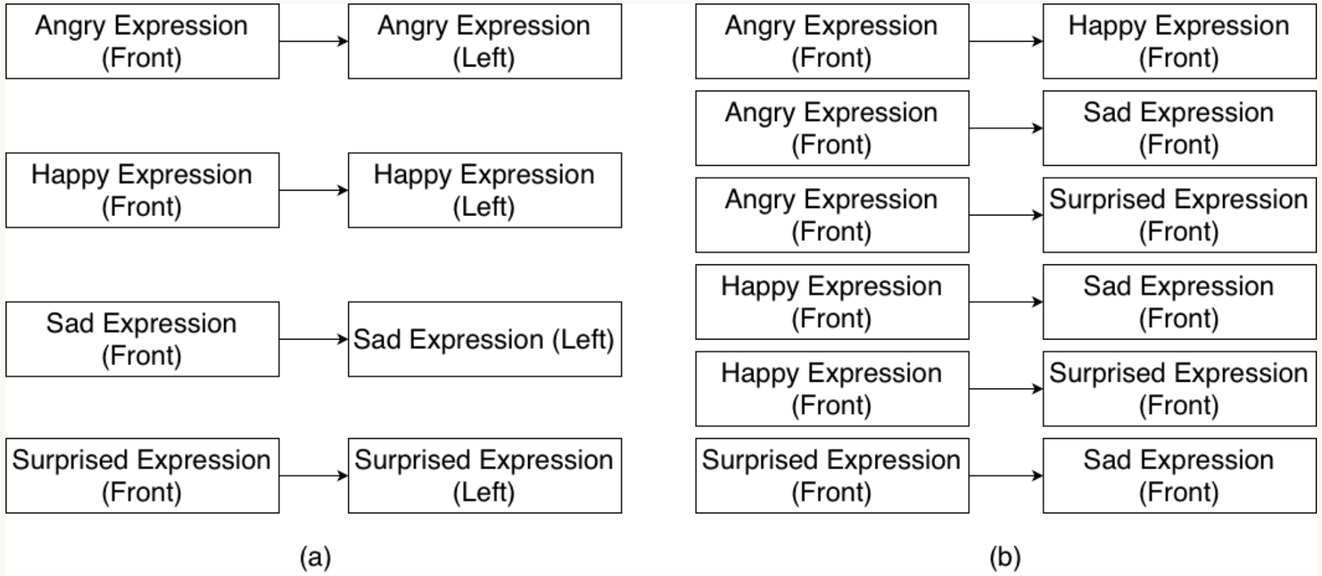


Fig. 2. Pair construction strategy used in the user study.

4.Experiments

Study Design

- **Forced-choice pairwise comparison** paradigm
- Participants compare two neural-rendered talking-head videos at a time
- Each comparison isolates one visual factor (expression or head pose)

Participants

- N = **80** participants recruited via Prolific
- Location: UK & US
- Fluent in English
- Desktop / laptop usage required

Procedure

- Web-based interface with informed consent
- Participants complete all tasks sequentially
- Each video pair evaluated on 6 dimensions:
  - Openness
  - Conscientiousness
  - Extraversion
  - Agreeableness
  - Emotional Stability
  - Naturalness (control)
- Forced-choice answers:
  - Left / Equal / Right

→ 4.Experiments

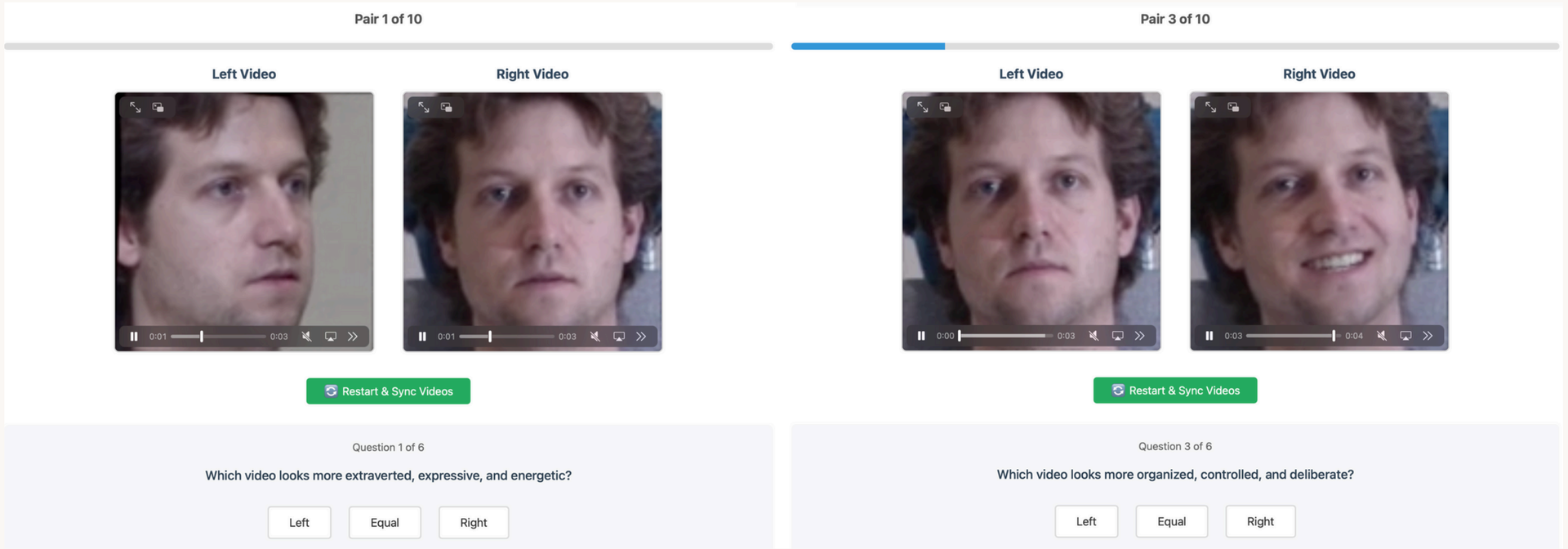
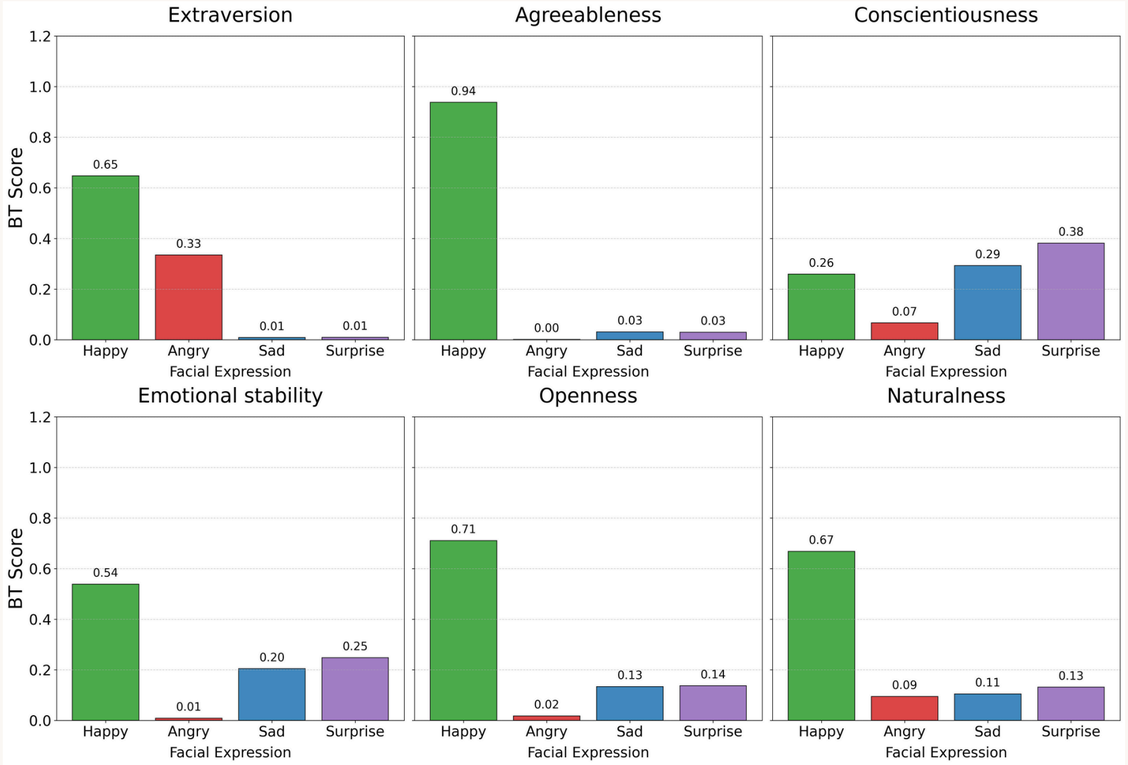


Fig. 3. Screenshots from the user study: a pair with the same expression (left) and different poses, and different expressions with a frontal view (right).

→ 5.Analysis and Results

Bradley–Terry Analysis

- We apply Bradley–Terry modeling to obtain probabilistic rankings of facial expressions for each trait.
- Results reveal a clear **dominance of happy** expressions for **positive social traits**:
  - Agreeableness: BT = 0.94
  - Openness: BT = 0.71
  - Strong effects also observed for:
    - Extraversion
    - Emotional Stability
- Key insight:
- Happy expressions are the strongest indicator of positive personality perception in neural-rendered faces.



→ 5.Analysis and Results

Arousal vs. Valence

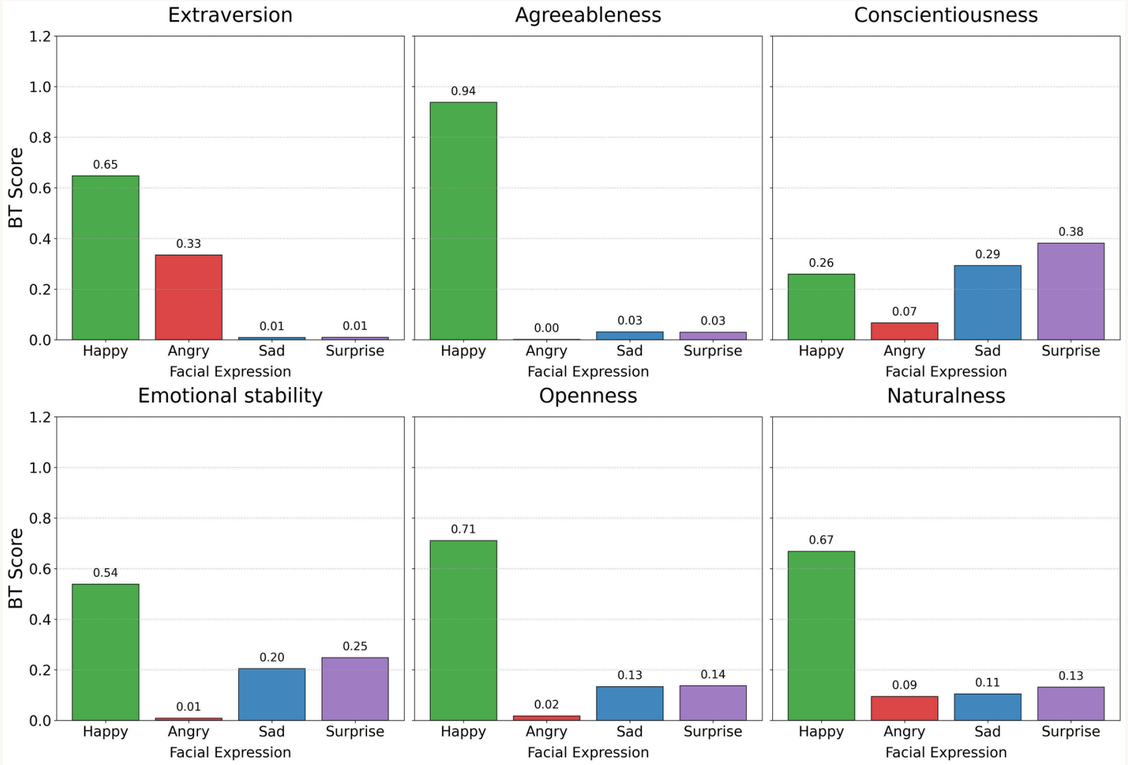
- **Angry expressions** also score relatively high in Extraversion (BT = 0.33), despite being negatively valenced.
- This suggests:
  - **High emotional arousal**, rather than positivity alone, contributes to perceived extraversion.

Conscientiousness & Naturalness

- Unlike other traits Surprise scores highest for conscientiousness (BT = 0.38).
- Happy expressions are perceived as the most natural, but do not dominate conscientiousness.

Interpretation:

Participants did not simply select the most natural-looking videos, indicating no halo effect.



→ 5.Analysis and Results

Pairwise Comparisons & Head Orientation Effects

Pairwise Emotion Comparisons

- Binomial tests confirm:
  - **Happy** expressions **dominate** Angry and Sad expressions especially for:
    - Agreeableness
    - Emotional Stability
- Example:
  - Happy vs. Angry:
    - Agreeableness = 1.00*
    - Emotional Stability = 0.94*
- Sad vs. Surprise:
  - No significant differences across traits (p > 0.05)
  - → **Nearly indistinguishable personality profiles**

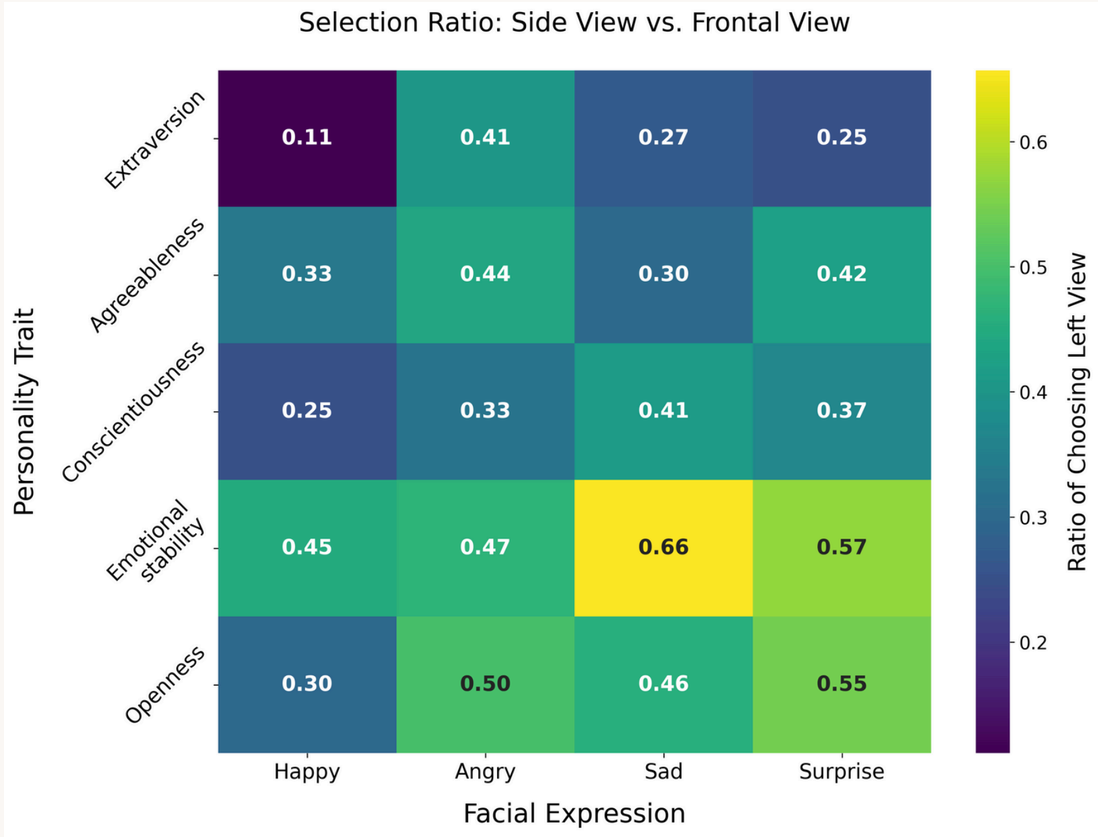
Table 1. Pairwise comparison win rates for frontal views. Values represent the win proportion of the second emotion (B) in each pair (A vs. B). Asterisks indicate statistical significance from binomial tests ($*p < 0.05, **p < 0.01, ***p < 0.001$).

Pair (A vs. B)	Extra.	Agree.	Cons.	E. Stab.	Open.	Nat.
Angry vs. Happy	0.67**	1.00***	0.80***	0.96***	0.94***	0.84***
Angry vs. Sad	0.04***	0.97***	0.79***	0.97***	0.95***	0.59
Angry vs. Surprise	0.00***	0.94***	0.87***	0.97***	0.85***	0.55
Happy vs. Sad	0.01***	0.04***	0.52	0.28***	0.13***	0.11***
Happy vs. Surprise	0.03***	0.03***	0.62	0.29***	0.16***	0.16***
Sad vs. Surprise	0.56	0.53	0.49	0.59	0.58	0.60

→ 5.Analysis and Results

Influence of Head Orientation

- Comparing frontal vs. left-facing views under identical expressions:
  - Frontal view perceived as more:
    - Extraverted
    - Emotionally stable (in most cases)
- Exception: For **sad expressions, left-facing orientation** favored for emotional stability.



- **Head orientation** does not carry a fixed social meaning. Its effect **depends on** both the underlying emotional expression and the personality trait being judged

→ 6.Conclusion and Future Work

Conclusion

- We studied personality perception in neural-rendered talking-head videos using:
  - 4 facial expressions
  - 2 head orientations
  - controlled pairwise comparisons
- Key findings:
  - Facial expression is the primary driver of perceived personality
    - Happy expressions dominate:
      - Extraversion
      - Agreeableness
      - Emotional Stability
  - Sad and surprised expressions are perceived as conceptually similar
  - Head orientation interacts with expression:
    - Frontal view → more extraverted
    - Side view → higher emotional stability, especially for sad and surprised expressions
  - Participants rely on dynamic nonverbal cues, not perceived naturalness

Personality perception emerges from dynamic changes in expression and head pose, not from static realism.

→ 6.Conclusion and Future Work

Design Implications

- Findings can be translated into automated design rules for:
  - animation
  - games
  - virtual agents
- Example:
  - switch from frontal → side view when expressing sadness
  - use high-energy expressions + frontal view to emphasize extraversion and agreeableness

Future Work

- Integrate auditory cues (voice, prosody, dialogue), especially for:
  - conscientiousness, which is weakly conveyed visually
- Study longer interactions to examine:
  - temporal stability of personality perception
  - adaptation effects over time
- Extend beyond short-term exposure and single identity

Thank you for listening me

Q&A