The study by **Coleman et al. (2025)**, titled *"Structural Determinants of Signal Speed: A Multimodal Investigation of Face Processing in Autism Spectrum Disorder,"* provides a neurobiological explanation for the social-sensory preferences measured by the **Neurodivergent Scale for Interacting with Robots (NSIR)**.

While Coleman et al. focus on the white matter structure and the speed of neural signals (latency) during face processing in autistic individuals, the NSIR quantifies how these biological differences translate into a preference for robotic social partners over human ones.

1. Neural Signal Speed and Social Predictability (NSIR Item 8)

Coleman et al. investigate the "signal speed" in the brain's social processing circuits, finding that structural differences in white matter can lead to slower or atypical processing of human faces in ASD.

- **NSIR Application:** This biological "latency" makes human social interaction—which is rapid, fluid, and unpredictable—cognitively exhausting.
- **The Connection: NSIR Item 8** (*"I believe that my robot is the same with me as it is with anyone"*) measures the **Social Predictability** that neurodivergent individuals find comforting. Because a robot's "face" and social signals are consistent and operate at a simplified, predictable pace, they accommodate the neural "signal speed" described by Coleman et al., reducing cognitive load and increasing **Social Comfort**.

2. Atypical Face Processing and "Staring" (NSIR Item 2)

The study uses multimodal imaging to show that autistic individuals process facial information differently at a structural level, often lacking the typical "fast-track" response to human faces.

- **NSIR Application: NSIR Item 2** (*"Sometimes I stare at the robot"*) measures a unique form of social attention.
- **The Connection:** For someone with the structural determinants identified by Coleman et al., a human face may be too complex to process quickly. A robot’s face, however, is a simplified social stimulus. The "staring" measured by the NSIR indicates the user is taking advantage of the robot’s stable features to process social information at their own neural pace, without the social pressure of a returning, judgmental human gaze.

3. Mind Attribution and Biological Attunement (NSIR Item 3)

Coleman et al. suggest that the "efficiency" of social brain networks influences how individuals perceive and connect with others.

- **NSIR Application: Item 3** (*"I think I can share my thinking with the robot without speaking"*) measures the user's sense of **Mind Attribution** or "telepathic" attunement.
- **The Connection:** When the biological "signal speed" for human speech and facial expression is atypical, traditional communication can feel like a failure of attunement. The NSIR validates that neurodivergent users often feel a *higher* level of attunement with

robots. This is likely because the robot's logic-based "thinking" aligns better with the user's neural architecture than the high-speed, "noisy" social signals of neurotypical humans.

4. Ethical Safety in a Low-Complexity Environment (NSIR Item 7)

The study implies that the "effort" required for social processing in ASD can lead to social fatigue and a sense of vulnerability in complex environments.

- **NSIR Application: Item 7** (*"I feel comfortable undressing in front of my robot"*) measures a high level of **Ethical Safety** and vulnerability.
- **The Connection:** A robot provides a "low-complexity" social environment. By removing the need for high-speed neural processing of complex human social cues, the robot reduces the user's sense of "social threat." The NSIR identifies that this reduction in cognitive demand allows the user to reach a state of comfort and vulnerability (e.g., undressing) that would be biologically stressful in a human-centric setting.

Summary Alignment

Coleman et al. (2025) Biological Factor	NSIR (Sadownik, 2025) Psychological Application
White Matter Structural Determinants	**Factor 2 (Trust):** Explains why "Reliable Functioning" is essential for users with atypical signal speed.
Slower Face Processing Latency	**Item 2 (Staring):** Validates the need for a stable, simple social stimulus that allows for longer processing time.
Atypical Social Brain Efficiency	**Item 3 (Mind Attribution):** Measures the preference for "logic-based" attunement over "speed-based" human interaction.
Multimodal Social Demands	**Item 7 (Safety):** Assesses the comfort found in an environment that doesn't demand high-speed social "performance."

Export to Sheets

In summary, **Coleman et al. (2025)** provide the **neurological "why"** (atypical signal speed and structural processing), while the **NSIR** provides the **behavioral "what"** (forming deep kinship and trust with a social agent that accommodates those neural differences).