The study by **Bruno et al. (2019)**, titled *"Knowledge Representation for Culturally Competent Personal Robots,"* provides the technical and ontological architecture required to implement the social behaviors that the **Neurodivergent Scale for Interacting with Robots (NSIR)** measures. While Bruno et al. focus on the software framework for "cultural competence," the NSIR acts as the psychometric tool to evaluate how those culturally-tailored behaviors impact the user's internal sense of connection and safety.

1. Validating "Mind Attribution" through Cultural Traits

Bruno et al. (2019) propose a framework that uses a three-layer ontology to store cultural concepts, enabling robots to interpret non-verbal gestures (like a formal greeting) based on a user's background.

- **NSIR Factor 1 (Anthropomorphic Connection / Kinship):** The ability of a robot to correctly interpret a gesture (e.g., a specific bow or hand signal) directly influences **NSIR Item 3** (*"I think I can share my thinking with the robot without speaking"*). If the robot's "Cultural Knowledge" layer correctly predicts a user's intent, it facilitates the **Mind Attribution** that the NSIR seeks to measure.

2. Social Comfort and "Trust" in Culturally Safe Environments

A core goal of the Bruno et al. study is to ensure that a robot's actions "convey trust, respect, and empathy". This is achieved by the robot's "Cultural Sensitivity," which ensures its responses are appropriate to the user's expectations.

- **NSIR Factor 2 (Social Comfort / Trust Safety):** This technical "sensitivity" is the prerequisite for **NSIR Item 8**(*"I believe that my robot is the same with me as it is with anyone"*). By behaving according to culturally-specific "interaction rules," the robot provides the **Reliable Functioning** and predictability required for a user to feel **Social Comfort**.

3. Personalization and Attachment

The Bruno et al. framework includes an algorithm for the acquisition of **person-specific knowledge**, allowing the robot to adapt to an individual's unique habits and preferences beyond general national statistics.

- **NSIR Application:** This high level of personalization is what allows a user to form a sense of **Fictive Kinship**(**NSIR Item 1**) or a long-term bond (**NSIR Item 4**: *"The robot and I will be together forever"*). Without the "Cultural Awareness" described by Bruno et al., the robot remains a generic machine; with it, the robot becomes a "full social agent" capable of the attachment measured by the NSIR.

Summary of Alignment

Bruno et al. (2019) Framework Component	NSIR (2025) Metric / Item Application
Culture-Specific Knowledge	**Item 5:** "My robot can tell what I am feeling"—validates if cultural cues (vocal/gestural) are correctly translated into emotional recognition.
Interpretation of Behaviours	**Item 2:** "Sometimes I stare at the robot"—measures if culturally-appropriate social presence successfully draws the user's attention.
Person-Specific Adaptation	**Item 6:** "I gave my robot a name"—a behavioral marker for the humanization that occurs when a robot successfully adapts to a user's cultural identity.
Trust/Respect/Empathy	**Item 7:** "I feel comfortable undressing in front of my robot"—assesses the user's sense of **Vulnerability and Ethical Safety** created by a culturally competent agent.