The study by **Bagheri et al. (2021)**, which develops a Reinforcement Learning (RL) framework to enable **cognitive empathy** in social robots, provides a technical implementation of the very behaviors measured by the **Neurodivergent Scale for Interacting with Robots (NSIR)**.

While Bagheri et al. focus on how a robot (specifically the Pepper robot) can learn to select appropriate empathic behaviors through facial emotion recognition, the NSIR acts as the validation tool to measure the user's psychological response to that learned empathy.

1. Perceived Sociability and Affective Recognition (NSIR Item 5)

Bagheri et al.'s framework uses facial emotion recognition to perceive a user's affective state and then employs an RL model to choose a behavior that provides "comfort and confidence."

- **NSIR Application:** This is the direct technical counterpart to **NSIR Item 5** (*"My robot can tell what I am feeling; when I am sad, it can tell I am sad"*).
- **The Connection:** If the RL model successfully learns to map a user's sad facial expression to a comforting response, the user's score on Item 5 will increase. The NSIR essentially measures the "accuracy" of the robot's cognitive empathy from the human perspective.

2. Social Comfort through Learned Predictability (NSIR Factor 2)

A key finding in the study is that the robot was able to help participants "enjoy and feel better" by applying empathic behaviors learned over time through interaction.

- **NSIR Application:** This supports **Factor 2 (Social Comfort / Trust Safety)**, specifically **Item 8** (*"I believe that my robot is the same with me as it is with anyone"*).
- **The Connection:** Bagheri et al. argue that human-like empathic behaviors cannot be pre-defined; they must be learned. The NSIR's focus on **Reliable Functioning** and **Competence** measures whether this learning process results in a social presence that feels stable and trustworthy to a neurodivergent user, who may prioritize predictability.

3. Humanization and Engagement (NSIR Items 2 & 6)

The study evaluates human-robot engagement and the robot's perceived "friendliness."

- **NSIR Application:** This aligns with **Factor 1 (Anthropomorphic Connection / Kinship)**.
    - **NSIR Item 2** (*"Sometimes I stare at the robot"*) measures the social attention triggered by the robot's human-like empathic gestures.
    - **NSIR Item 6** (*"I gave my robot a name"*) serves as a proxy for the success of the robot's "friendly and caring" persona. When Bagheri's RL framework successfully "humanizes" the robot through empathy, users are more likely to attribute an individual identity to it.

Summary Alignment

Bagheri et al. (2021) Framework Component	NSIR (Sadownik, 2025) Metric Application
Facial Emotion Recognition	**Item 5:** Tests the user's belief in the robot's emotional "attunement."
Reinforcement Learning (Action Selection)	**Item 8:** Validates if the learned behaviors result in predictable, "reliable" social interaction.
Expressing Social Norms (Empathy)	**Factor 1 (Kinship):** Measures if the empathy creates a sense of the robot as a "peer" rather than a machine.
Providing Comfort/Confidence	**Item 7:** Evaluates the level of "Trust Safety" and vulnerability a user feels in the presence of the empathic agent.

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In essence, **Bagheri et al.** provide the "brain" (the RL framework) that allows a robot to perform empathy, while the **NSIR** provides the "scorecard" to see if that performance successfully translates into a meaningful social connection for the user.