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Research on the Shift of Preschool Children's Social Referencing and Educational Responses in the Intelligent Era

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Abstract: With the rapid advancement of digitalization and intelligence, smart technologies are progressively integrating into the learning environments and daily lives of preschool children. The introduction of intelligent technologies has fundamentally transformed how young children perceive and interact with the world, bringing profound changes to traditional patterns of social referencing. Grounded in the developmental characteristics of preschool children's social cognition, this paper systematically examines the shift in social referencing during the intelligent era and explores its far-reaching educational implications. The study identifies three principal shifts in social referencing among preschool children in the age of intelligence. First, the reference object transitions from exclusively interpersonal agents to human-machine hybrids, as children increasingly turn to intelligent devices alongside human caregivers. Second, the reference content evolves from primarily emotional signals to diverse and multimodal forms of information. Third, the basis for reference shifts from relational dependency on familiar individuals to multi-source evaluation involving both human and technological inputs. In response to these shifts, the paper argues that education should continue to emphasize the core role of real others as primary reference points, expand opportunities for authentic social interaction, and foster preschoolers' initial abilities in identifying, evaluating, and negotiating among multiple reference sources. Re-examining social referencing within the context of intelligent technology can help more accurately define the boundaries of technological influence on preschool children's social cognition and provide valuable theoretical and practical guidance for supporting the healthy development of their social referencing skills in the intelligent era.

Keywords: intelligent era; intelligent technology; preschool children; social referencing; authentic interaction

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1. Introduction

The continuous integration of intelligent technologies in early childhood education is reshaping how preschool children perceive the world and engage in social interactions. A national policy initiative issued in 2026 emphasizes human-machine collaboration, intelligent companionship, and foundational digital literacy as key priorities for educational advancement. National guidelines for early childhood education affirm that learning activities should be grounded in children's everyday experiences, with play serving as the primary mode of engagement, supporting exploration and learning through hands-on activities and direct personal experience. Preschool age represents a critical developmental window for social cognition, emotional understanding, and interpersonal relationship formation. Consequently, the application of intelligent technologies in this context demands thoughtful consideration and careful implementation. A recent national awareness campaign focused on safeguarding childhood development in digitally saturated environments underscored the

irreplaceable value of authentic, face-to-face experiences and play-based learning. It highlighted the importance of nurturing warm, responsive relationships and encouraged families to prioritize sustained, high-quality parent-child interaction—ensuring that digital tools complement rather than displace human connection, teacher guidance, or peer engagement [1, 2]. Therefore, as intelligent systems increasingly assume roles in information delivery, knowledge support, and affective responsiveness, early childhood education must rigorously examine the appropriate scope, design principles, and pedagogical boundaries for such technologies.

Social referencing describes the process by which young children seek facial and vocal cues from trusted adults when encountering unfamiliar or ambiguous situations, using those cues to inform their behavioral responses [3, 4]. Contemporary research recognizes this not as a transient infant behavior but as an evolving social cognitive capacity that persists and adapts across development. As children mature, their circle of reference broadens beyond immediate caregivers and familiar community members to include wider societal models, and the signals they attend to evolve from basic expressions and gestures toward more nuanced social evaluations and normative behavioral patterns. For preschool children, social referencing functions both as a vital strategy for emotional regulation and as a fundamental mechanism for interpreting the external world—especially when their own experiential knowledge remains limited.

Advances in intelligent technologies are transforming the nature of social referencing for preschool children—including who or what serves as a reference source, what kinds of information are drawn upon, and the criteria used to assess reliability. Voice assistants and social robots, characterized by responsive dialogue, adaptive language use, and perceptible anthropomorphic features, function as persistent, interactive information partners. Empirical observations indicate that preschool children frequently attribute social agency to such devices and engage with them as if they possess relational qualities. Studies involving children aged three to six show that they selectively consult voice assistants for factual knowledge and differentiate among sources based on domain specificity and prior accuracy—suggesting these tools actively enter children’s developing processes of social information evaluation. Thus, children’s reference ecology is shifting from a predominantly interpersonal framework centered on parents, educators, and peers toward a hybrid configuration that includes both human and artificial agents. Correspondingly, the informational basis for judgment may extend beyond expressive, tonal, and behavioral cues rooted in close relationships to encompass explanatory, knowledge-based, and evaluative inputs generated algorithmically [5]. Intelligent technologies not only facilitate knowledge acquisition but may also shape children’s emerging capacities for social judgment and behavioral self-regulation. Experimental evidence demonstrates that the presence of socially responsive robotic agents can influence prosocial behaviors such as sharing among three-year-olds. In this context, artificial agents have become part of children’s reference landscape—expanding the range of potential sources consulted during uncertainty, and broadening the types of information considered relevant for sense-making beyond emotionally grounded interpersonal signals to include computationally derived input.

In the intelligent technology era, transformations in preschool children’s social referencing reflect not a simple substitution of human agents with machines, but a systemic reconfiguration of reference sources, informational content, and evaluative foundations. On one hand, intelligent tools introduce novel pathways for information access and broaden opportunities for socially mediated learning; on the other, preschool children’s capacities to critically assess information accuracy and evaluate technological reliability remain immature [6]. When multiple entities—including adults, peers, and intelligent systems—offer explanations or judgments, children face new challenges: Which source should be prioritized? What kinds of information carry greater weight? And what criteria should guide their interpretation? Current scholarship has largely examined related phenomena through lenses such as selective trust, child-robot interaction dynamics, and learning outcomes with voice assistants—yet few studies adopt social

referencing as a core theoretical framework to systematically analyze how intelligent technologies reshape the structure and function of this foundational social-cognitive process. Building on established understandings of social referencing, this paper examines emergent patterns in the reference objects, informational content, and evaluative bases employed by preschool children in technology-rich contexts, and proposes educationally grounded considerations for practice and policy in early childhood settings.

2. Multiple Shifts of Preschool Children's Social Referencing in the Intelligent Era

2.1. The Referent Shifts from Interpersonal Subjects to Human-Machine Composites

Traditional social referencing arises from direct interpersonal relationships between preschool children and real-life others. Parents, teachers, and peers provide emotional, motor, and verbal reference signals while also engaging as co-actors in shared activities. Children dynamically adjust their behavior in response to immediate interpersonal feedback, and these others, in turn, continuously modulate their expressions according to the child's evolving state. Thus, social referencing is not a unidirectional transmission of social information from adults to children, but an ongoing, interactive process through which meaning is co-constructed [3, 7]. The holistic and continuous nature of authentic social interaction means that children interpret others' reactions within the integrated context of persons, actions, and situational features—not through isolated recognition of discrete expressions or behaviors.

As intelligent voice assistants and social robots increasingly enter the daily lives of preschool children, the range of 'others' with whom children interact has expanded beyond parents, teachers, and peers. Artificial intelligence systems capable of natural language interaction, real-time responsiveness, and iterative feedback can now participate—albeit partially—in children's ongoing activities. The educational role of intelligent technology has evolved from that of a passive instructional tool to an active agent with limited but observable behavioral capacities. Consequently, the human-machine relationship is shifting away from a hierarchical model of human control toward a more nuanced, collaborative configuration. During early childhood, the developing concept of social agency leads children to attribute social significance to multimodal cues—including sounds, spoken language, physical actions, and timely responses—potentially extending such attribution to technological entities [3, 8].

Preschool children already demonstrate differentiated engagement with intelligent media in everyday practice: some proactively deploy voice assistants to resolve challenges and form quasi-social attachments with these systems. With cognitive maturation, children progressively discern distinctions between artificial intelligence and human interlocutors, gradually forming a foundational awareness of technological affordances and limitations. Therefore, the integration of humans and machines in social referencing should not be interpreted as AI displacing human referents, but rather as generating layered, interdependent pathways for sense-making [9, 10]. Following technological feedback, children may seek adult clarification, or they may synthesize input from teachers, peers, and AI systems to construct a coherent understanding of the situation.

The fundamental transformation introduced by human-machine integration lies in the structural reconfiguration of social referencing itself [7]. Historically, such referencing unfolded primarily along interpersonal axes connecting children with significant adults and peers. The inclusion of AI introduces a triadic architecture wherein children, human referents, and technological agents jointly shape interpretation. Children now draw not only on direct human input to understand the world, but also on human mediation to interpret technological output. Adults thus assume a newly salient function: guiding children to differentiate between algorithmic responses and embodied, context-sensitive human reactions. Rather than supplanting human referents, AI catalyzes the emergence of novel relational constellations among children, adults, and technology. For preschoolers, the critical developmental shift is not whether AI attains human-like

referent status, but that the process of interpreting social situations evolves from reliance on singular interpersonal connections to navigation of multifaceted, hybrid human–technology reference networks.

2.2. The Referential Content Shifts from Emotional Signals to Diverse Information

As language, psychological, and social comprehension abilities develop, preschool children begin attending to more complex social cues and comparing the reactions of different individuals. Traditional social reference content primarily includes facial expressions, vocal tone, gaze direction, body movements, and behavioral outcomes—signals that rarely convey definitive conclusions. For instance, a frown may reflect worry or dissatisfaction; its precise meaning depends on contextual factors such as the object of attention, the interpersonal relationship involved, and subsequent behaviors. Social significance emerges through the dynamic interplay of situational elements, requiring individuals to synthesize fragmented cues into coherent social events. Social decisions typically rely on the ongoing integration of perceptions about others' traits, intentions, and contextual circumstances. The value of social information lies not in isolated signals but in the relational patterns they form [11]. During the preschool years, children increasingly draw upon diverse social cues beyond single emotional expressions. They can recognize signs of remorse in others and modulate their responses—such as forgiveness—based on the presence and roles of bystanders. In interpersonal situations, factors including adherence to social norms, expressions of regret following behavior, and the nature of existing social relationships all influence preschool children's subsequent social evaluations. The development of social referencing in this age group involves more than a simple transition from nonverbal to verbal cues; it entails the gradual construction of an integrated cue structure encompassing emotions, actions, relational dynamics, social judgments, and behavioral consequences.

Intelligent media have become embedded in daily life, introducing new forms of reference information for preschool children. Social signals from real people arise organically within specific interactions, whereas artificial intelligence systems actively interpret and clarify situations using language, sound, visual representations, and programmed feedback. These systems possess strong capabilities for integrating, processing, and delivering structured outputs. Consequently, their educational function increasingly extends into how information is presented and explained. As a result, the reference content available to preschool children now encompasses not only physical and behavioral signals but also linguistically encoded, explanatory, and evaluative information organized by technical systems.

A subtle yet consequential distinction exists between these two sources of reference information. Natural social signals often preserve substantial ambiguity, prompting preschool children to sustain observation, engage in experiential learning, and formulate hypotheses based on others' responses. In contrast, intelligent feedback tends toward explicitness, transforming content that would otherwise require gradual, child-led interpretation into relatively unambiguous explanations. While clarity enhances efficiency for adults, early social-cognitive development does not depend solely on acquiring final interpretations. Preschool children need opportunities to progress through perception, expression, trial, feedback, and adjustment—transforming external social input into personal understanding [6]. In the context of intelligent technology, educators cannot—and should not—exclude artificial intelligence from pedagogical practice; however, they must proactively mitigate associated risks, particularly those involving cognitive substitution and diminished independent reasoning. External support must remain firmly oriented toward scaffolding understanding—not supplanting it.

2.3. The Referential Basis Shifts from Relational Trust to Multi-Source Trade-Offs

Social referencing does not imply indiscriminate adoption of external information by children. In early childhood, this process is primarily grounded in attachment and familiarity, reflecting a strong relational foundation. Familiarity, emotional closeness, and sustained shared experiences naturally elevate the referential priority of significant others.

As self-awareness, social understanding, and evaluative capacities mature during the preschool years, children increasingly integrate behavioral cues—beyond personal attributes—into their social judgments. They begin to recognize others' commitments and form trust assessments based on evaluations of moral conduct; with age, reliance on behavioral indicators for judging others becomes more consistent.

The evolution of selective referencing aligns closely with the emerging social cognition abilities of preschool children. As psychological development accelerates, they progressively grasp that others may hold preferences and beliefs distinct from their own, and begin incorporating socially relevant considerations—such as whether an action reflects consideration for others—into character appraisals. In the later preschool period, children weigh contextual cues when making trust-related decisions, aligning those cues with the immediate situation rather than relying solely on prior global impressions. Thus, multi-source weighing should be understood not as formal logical reasoning, but as an emergent capacity to compare and integrate diverse social cues [3, 12].

When artificial intelligence is introduced into social referencing contexts, preschool children may encounter multiple reference sources simultaneously—such as parents, teachers, peers, and intelligent systems—whose responses may align or differ. Children must not only interpret what a given response conveys, but also assess how various responses relate to one another. Their engagement with intelligent media manifests in varied patterns—including reliance, collaborative interpretation, and guided exploration—some children recognizing technological limitations and supplementing media input with adult guidance or personal experience; however, reliance remains the predominant pattern [12].

Multi-source weighing differs fundamentally from general assessments of factual accuracy. Social referencing occurs within concrete, situated interactions [13, 14]. Even when a source provides factually correct information, it may lack sensitivity to the interpersonal dynamics or affective dimensions a child is navigating. When preschool children navigate peer interactions, the appropriateness of reference information depends not only on verbal correctness but also on its resonance with relational context, behavioral implications, and the child's subjective experience. Hence, the weighing involved is best characterized as situational social evaluation rather than a quantitative comparison of source reliability.

The transition from relationship-based reliance to multi-source weighing signifies a growing capacity for active participation in social referencing. While familiarity continues to serve as a stable and influential anchor, children increasingly integrate observations of individual behavior, situational features, lived experience, and technological feedback [15]. Given their still-developing regulatory and integrative capacities, preschool children may find it challenging to resolve inconsistencies across sources consistently; moreover, response speed, tone, and persistent availability of technological outputs can shape their choices. The central educational challenge lies not in prescribing which source children ought to prioritize, but in safeguarding opportunities for observation, comparison, and iterative verification within multi-source environments.

3. Educational Responses to Preschool Children's Social Referencing in the Intelligent Era

3.1. Ensuring the Core Status of Human Referents

The core reference status of real others stems from shared presence rather than informational advantage. Parents, teachers, and peers participate in children's lived relational contexts, jointly perceiving unfolding events while also recognizing children's prior experiences and current developmental states. Their responses arise not as decontextualized information outputs, but as socially grounded reactions shaped by ongoing relational history [16]. The immediacy of human connection to context is essential for social referencing. Preschool children construct understanding of social norms, emotional expressions, and behavioral significance through real-time facial cues, direct

verbal feedback, and tangible consequences of their actions within authentic interactions. Interpersonal exchanges dynamically adapt to children's responses, positioning children not as passive recipients but as active co-regulators who influence interactional flow. While artificial intelligence can generate responses to inputs, it lacks the capacity to fully apprehend familial bonds, peer dynamics, or children's implicit emotional cues. As social referencing increasingly involves emotional interpretation, nuanced interpersonal coordination, and value-laden decision-making, the richness of contextual information embedded in real relationships becomes indispensable. Ensuring this core reference status requires adults to transcend roles limited to supervising intelligent tool usage. When technology provides ready answers, adults must assume responsibility for contextual interpretation and relationship-sustaining responses. In moments of children's uncertainty or hesitation, caregivers and educators must not only assess technical accuracy but also support children in recognizing others' feelings, interpreting behavioral motivations, and anticipating the relational implications of their own responses. As intelligent technologies evolve from tools to educational participants, the irreplaceable value of human agency in educational relationships must be reaffirmed. The core status of real others does not necessitate excluding technology from children's lives; instead, it calls for integrating technological outputs into interpersonal dialogue. AI-provided content may serve as a catalyst for parent-child conversations, teacher-student reflections, or peer discussions, with ultimate meaning-making and relational calibration occurring within authentic human interactions. Technology's appropriate role in social referencing is not to function as a terminus for resolving uncertainty, but as a bridge that sustains and enriches continuous human communication.

3.2. Expanding the Social Referencing Field of Real Interactions

The development of social referencing ability depends on rich and varied social contexts. Children gradually learn to interpret the same behavior differently across situations only through exposure to diverse individuals, relationships, and outcomes. While highly standardized interactions may simplify comprehension, they also limit opportunities for children to encounter a broad range of social cues. Preschool children demonstrate the capacity to adjust their interpretations based on the identity of others present, the nature of observed behaviors, and associated social outcomes—highlighting that authentic social contexts serve as vital sources of information for understanding people.

Enriching the social referencing environment goes beyond increasing outdoor time or peer interaction duration. More critically, it involves deepening the authenticity and diversity of preschoolers' real-world social experiences. Moments such as differing viewpoints during open-ended play, collaborative role coordination in group tasks, emotional expressions within family routines, and interactions with new acquaintances in community settings all involve dynamic, evolving interpersonal exchanges. Young children need opportunities to observe and respond to others' uncertainty, boundary-setting, and willingness to accommodate—and to refine their interpretations in light of varying behavioral outcomes. In contrast to human-computer interactions governed by fixed protocols, everyday life events offer greater unpredictability and thus more genuine conditions for developing social referencing skills. As intelligent media become increasingly embedded in children's daily routines, physical engagement, face-to-face connection, and multisensory experiences risk being displaced by interface-mediated ones. Should digital environments increasingly supplant physical spaces as the primary arenas of early childhood experience, the nuanced complexity of real-life social situations may recede from children's lived awareness. Preschool education should therefore prioritize safeguarding irreplaceable real-world social experiences over expanding technical resources or digital infrastructure. Kindergarten activities—including play, daily routines, joint inquiry, and peer collaboration—must preserve ample time for children to observe, pause, reflect, and engage in mutual negotiation. Families also constitute an essential dimension of this social landscape. Shared meals, involvement in age-appropriate

household responsibilities, parent-child play, and family conversations—though informal—continuously model for young children how people identify challenges, express feelings, and respond to consequences. Intelligent tools can deliver abundant content, yet they cannot replicate the relational continuity inherent in everyday life. Only through repeated, embodied participation in authentic interactions can preschool children integrate fragmented social cues into coherent, stable understandings.

Intelligent media may support real-world social learning, provided they function as bridges—not substitutes—for lived experience. When preschool children gain initial insights through technology, those insights should be followed by discussion with peers and adults, observation in daily settings, and application through play-based verification [14, 15]. Digital tools do not conclude the process of social referencing; rather, they initiate further opportunities for authentic interaction. The goal of enriching the social referencing environment is not to separate virtual and physical realms, but to ensure digital feedback remains integrated with, and responsive to, the ongoing reality of children's social lives.

3.3. Cultivating the Ability of Identification and Negotiation for Multiple Referencing

The new requirements imposed on preschool children by the human-machine hybrid environment focus not on acquiring complex technical knowledge, but on gradually recognizing that different reference sources may yield divergent feedback. Preschool children need to understand that human responses are shaped by individual perspectives, and that technical feedback does not inherently mirror objective reality. Children already demonstrate emerging capacities to make differentiated judgments using social cues such as verbal commitments and behavioral outcomes, and increasingly adjust their choices in response to contextual signals. These competencies lay the groundwork for multi-reference identification, though their consistency and applicability across contexts remain limited.

For preschool children, identification abilities begin with awareness of reference sources. They need to progressively recognize that reactions originate from distinct entities—such as parents, teachers, peers, or artificial intelligence—and that agreement among these sources is neither automatic nor guaranteed [16]. When discrepancies arise among reference sources, educational practice should avoid prematurely resolving contradictions for children. Instead, such differences can be reframed as opportunities to explore the nature of social relationships. Following identification, negotiation becomes essential. Much information encountered in daily life resists binary classification as correct or incorrect; social interaction is inherently relational and dynamic. Children must learn to interpret others' positions while articulating their own feelings, and revise initial understandings in light of new feedback. Thus, multi-reference identification extends beyond assessing source reliability to encompass coexistence with diverse viewpoints and the gradual formation of reasoned judgments. Adults can leverage real-life instances where human and machine inputs differ to support children's reflective reconfirmation. Emphasizing observation, inquiry, attentive listening, and hands-on exploration proves more effective than abstractly prescribing critical thinking.

Education must safeguard children's right to revisit and revise judgments [12]. Intelligent media often present information with high apparent certainty, yet preschool children have not yet developed mature capacities for evaluating information quality. Nevertheless, the developmental immaturity of young children's cognition should not justify adult withdrawal from dialogic engagement. The absence of sustained, responsive guidance—and reliance on rigid, binary control strategies such as unconditional permission or prohibition—undermines children's capacity to translate ambiguous intentions into clear personal needs and to internalize external norms as part of their own cognitive framework. If adults simply substitute a technical answer with an alternative authoritative answer, children merely shift dependence from one source to another. A more constructive approach is to support children in tolerating uncertainty, allowing multiple perspectives to coexist, and fostering understanding through sustained observation, interaction, and action. The educational aim is not to instill generalized

skepticism toward technology, but to nurture foundational habits of social judgment. Any single reference source may serve as a useful cue for interpreting situations, but it must not displace children's direct observation and lived experience. Social references exist to scaffold children's evolving understanding of the world—not to establish permanent reliance on external validation. In the intelligent era, education's core task is to help preschool children rely on others without total dependence, use technology without treating it as definitive authority, and steadily construct their own social cognition through ongoing comparison, negotiation, and refinement.

4. Conclusion

The profound transformations introduced by the intelligent era extend beyond the substitution of human presence with machines in children's daily environments. Rather, they reside in the increasing complexity of the social reference framework that shapes children's development. Children may turn to technological interfaces for support, yet they also seek validation through authentic interpersonal relationships. They actively compare, interpret, and synthesize information drawn from both human and machine sources to construct personal meaning. Education's essential responsibility is not to preserve a technology-free childhood, but to ensure that, amid technological integration, children continue to ground their understanding of the world in genuine relationships, embodied experiences, and autonomous inquiry.

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