

Perspective Taking, Empathy and Visual Impairment: A Theoretical Reflection on Embodied, Multimodal and Vicarious Processes to Promote Inclusive Educational Design

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Abstract: In the contemporary dialogue between special pedagogy and neuroscience, the mirror neuron system can be considered an opportunity to question how understanding of the other emerges from the intertwining of bodily experience, sensory information and the educational relationship. Perspective taking may be understood as the ability to assume a spatial point of view different from one's own and, at the same time, as a more complex process of decentring, through which a person distinguishes his/her own perceptual, emotional and cognitive position from that of others. This dimension is particularly relevant to empathy, since approaching the experience of the other seems to require continuous modulation between one's own body and the differentiation of the self. In light of these considerations, visual impairment allows this connection to be explored in depth, showing how access to the meaning of another person's action and experience can be organized through alternative sensory channels. The absence of visual perception thus becomes a theoretically generative condition for rethinking the embodied foundations of empathy and designing educational environments based on vicarious senses, such as hearing, touch and proprioception. Based on these premises, the contribution stimulates a theoretical-argumentative reflection on perspective taking, empathy and visual impairment within Embodied Education.



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1. Introduction

Understanding the mental and affective states of others supports social life, because it guides communication, fosters cooperation and makes it possible to anticipate intentions, actions and emotional experiences during the encounter. Within this relational space, empathy assumes a fundamental value and presents itself as a construct with fluid boundaries. Psychology, neuropsychology, cognitive neuroscience and the social sciences describe it with different emphases, sometimes overlap-

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ping affective sharing, emotional regulation and prosocial behaviours, with the risk of flattening processes that operate on different scales (Hall & Schwartz, 2019).

The present contribution develops from perception-action models and from the notion of embodied simulation, which describes the way in which the experience of others is translated into internal representations through sensorimotor patterns and somatic maps. Within this framework, the discussion on the mirror system is taken up from a contemporary perspective (Rizzolatti & Sinigaglia, 2019), opening a reflection that becomes particularly significant in relation to people with visual impairment. Indeed, much of the literature on mirror neurons has developed within vision-centred paradigms (Bonini et al., 2022). This orientation could prompt a critical revision when considering people who access the social world through different sensory channels. Visual impairment, read within this line of research, assumes a relevant theoretical value and makes it possible to interrogate the perceptual assumptions through which a substantial part of the literature has studied the understanding of others. Many paradigms on mirroring have privileged the visual observation of action; the experience of blind or visually impaired people therefore allows the question to be shifted towards the way in which the intentionality and emotion of others are recognized through voice, contact and bodily presence in shared space (Rizzolatti & Sinigaglia, 2010; Ricciardi et al., 2009; Arioli et al., 2021). In this regard, the body of the other is also understood through multimodal signals, which support alternative forms of access to the relationship and make the role of perceptual plasticity in processes of interpersonal understanding more evident (Berthoz, 2015; Sibilio et al., 2023).

In this scenario, it is worth emphasizing that, in the educational field, the teacher's voice may prefigure a relational vehicle of primary importance. Prosodic modulation, intensity and rhythmic variation constitute signals through which the person with visual impairment can interpret emotional states, attentional orientations and communicative intentions (Gentili et al., 2015). Alongside hearing, haptic perception broadens access to the other through contact and movement, supporting understanding processes that connect action and intentionality (Arioli et al., 2021). Alternative sensory perceptions can thus be intentionally valued in educational contexts, where body and voice mediate knowledge, relationship and shared construction of experience and reciprocal understanding (Sibilio, 2017; Di Tore et al., 2020; Sibilio et al., 2023).

Based on these premises, the present contribution aims to stimulate a theoretical-argumentative reflection on perspective taking, empathy and visual impairment within Embodied Education.

2. Neurocognitive architecture of empathy and redefinition of the mirror system

Being able to understand the mental and affective states of others constitute a pillar of our life within the social context, allowing us not only to communicate and interact effectively, but also to anticipate the actions, intentions and feelings of others (Rogers, 1957; Kaplan & Iacoboni, 2006; Decety et al., 2016).

In this article, the relevant constructs are kept analytically distinct. Emotional contagion denotes a relatively automatic sharing of affect, affective empathy refers to an other-oriented affective response, cognitive empathy concerns the understanding of another person's internal state, and mentalizing or Theory of Mind concerns the attribution of beliefs and knowledge. Perspective taking refers to adopting a view-

point different from one's own, whereas prosocial behaviour is considered a possible outcome rather than a necessary component of empathy (Hall & Schwartz, 2019). Action understanding, finally, concerns the recognition of an action and its goal. In this article, empathy refers primarily to cognitive empathy, understood as the embodied capacity to assume another's perspective while maintaining self-other distinction; affective empathy remains a complementary, analytically distinct process.

These processes may interact, but they are not interchangeable and cannot be inferred from the same tasks or neural activations (Cuff et al., 2016; Decety & Jackson, 2004).

Affective responsiveness to another person and the cognitive effort to understand their perspective may then interact, especially within educational relationships, but they remain analytically distinguishable processes. In this regard, the conception of empathy as a complex neurocognitive function naturally leads us to question the neural mechanisms that make its emergence possible. If empathy is neither a reflexive emotional response nor a purely inferential act, then its foundation must be sought in processes of embodied simulation capable of integrating body, perception and action within distributed neural networks. The perception-action model of empathy (Preston, 2007) holds that perceiving another's emotional state activates a corresponding affective, somatic and autonomic response in the observer, situating mirror-system research within a contemporary, less vision-centred reinterpretation of empathy.

Mirror neurons were initially identified in premotor and parietal areas of the macaque and were found to respond during both action execution and action observation. In humans, research indicates partially interacting but functionally distinguishable systems. The parieto-frontal action-observation network maps sensory descriptions of motor acts onto motor representations and contributes primarily to understanding action goals. Somatosensory and insular regions are more directly associated with vicarious bodily and affective processing, whereas mentalizing recruits additional cortical networks. All these systems cooperate, but it is important to point up that they should not be collapsed into a single distributed resonance system or treated as a complete neural explanation of empathy (Rizzolatti & Sinigaglia, 2010; Decety & Jackson, 2004; Gentili et al., 2015).

Furthermore, the available evidence concerning simulation without direct visual input also refers to different phenomena. For example, Gazzola et al. (2006) studied the overlap between listening to and executing hand and mouth actions in sighted adults. Schaefer et al. (2012) instead examined vicarious somatosensory responses during the visual observation of touch. And finally, O'Shea and Moran (2017) critically reviewed the still incompletely specified relationship between motor imagery and motor execution.

These findings weaken, or at least redefine, reductionist readings that have attributed to mirror neurons an exclusive or automatic role in empathy, emphasizing that the mirror system is one component, and not the component, of a broader architecture, sensitive to context, learning and individual history (Heyes, 2018).

3. Perspective change and bodily foundations of empathic experience

The idea just presented directly introduces the theme of perspective change as a central cognitive operation. If the distinction between self and other is not given once and for all, but must be continuously maintained and renegotiated, then empathy requires an internal transformation of the reference systems through which the sub-

ject organizes experience. It is within this theoretical space that the contributions of embodied cognition are situated and, more specifically, studies on spatial perspective taking, which offer a particularly fruitful framework for understanding the not merely visual nature of assuming another person's point of view. Early experimental studies on spatial perspective change date back at least to the 1970s, when it was observed that adopting another subject's point of view does not occur as a simple mental rotation of objects in space but involves an egocentric transformation that takes the observer's body as its reference (Huttenlocher & Presson, 1973). A second decisive step occurs with the work of Kessler and Thomson, who systematically formalized the difference between object rotation and spatial perspective taking, showing that assuming another person's point of view implies a simulation of the movement of one's own body in space, rather than an abstract transformation of visual coordinates (Kessler & Thomson, 2010).

In this context, *The Virtual Class* is cited as a measure of spatial perspective taking in children, rather than as a direct measure of empathy (Beatini et al., 2024). These studies showed that adopting a different visuospatial viewpoint may involve egocentric transformations and simulated changes in bodily position. It is important to underline that they do not directly measure affective empathy, mentalizing or the understanding of another person's biographical experience. In this contribution, spatial perspective taking is therefore used as a model of embodied decentring and not as an empirical equivalent of empathic perspective taking (Cuff et al., 2016; Hall & Schwartz, 2019; Kessler & Thomson, 2010).

In continuity with this reflection, the Embodied Education perspective makes it possible to connect the neuroscientific reading to a more concrete pedagogical question, centered on the way in which the school environment organizes the conditions of the encounter with the other. Interpersonal understanding involves the body, the voice and the organization of shared space. Then, educational experience can be designed through modalities capable of making more accessible the relational signals that support participation (Sibilio, 2017; Sibilio et al., 2023). For students with visual impairment, this aspect assumes particular relevance, given that the quality of access to the other also depends on the care with which the school makes bodily and social information usually entrusted to vision perceptible, enhancing the vicarious function of hearing and haptic perception in the construction of shared experience (Berthoz, 2015; Ricciardi et al., 2009).

4. Empathy and vicariance in visual impairment

The shift away from visual-only paradigms requires terminological precision. In this article, multimodal refers to the integration of information from more than one sensory channel, whereas supramodal refers to action representations that can be accessed through different modalities and are not tied to a single input format. The evidence reviewed here is not used to claim a fully amodal architecture of empathy. More specifically, Ricciardi et al. (2009) showed that, in congenitally blind participants, sounds of hand actions activated a premotor and temporo-parietal network overlapping with that recruited by visually observed actions in sighted participants.

Furthermore, before proceeding, it is useful to specify that visual impairment encompasses highly diverse conditions at perceptual and neurocognitive levels. Congenital blindness early orients the organization of experience through vicarious sensory channels, with relevant effects on the construction of representations of ac-

tion and of the other (Ricciardi et al., 2009; Arioli et al., 2021). Acquired blindness, instead, preserves a specific relationship with visual memory and with previously sedimented perceptual traces, making the link between cross-modal plasticity and the subject's bodily history more articulated (Gentili et al., 2015). Low vision also requires autonomous consideration, since residual vision can integrate with hearing and haptic perception in variable configurations, deeply influenced by the quality of educational and environmental mediations (Berthoz, 2015; Sibilio et al., 2023). Speaking of sensory vicariance, therefore, means interrogating a plurality of possible reorganizations of access to the other, avoiding the reduction of the experience of visual impairment to a single compensatory model. Recent evidence on intrinsic brain organization in blindness further supports this perspective, suggesting that sensory experience may shape the hierarchical organization of cortical gradients during naturalistic stimulation, rather than producing a simple replacement of one sensory channel by another (Ricciardi, 2025). In this regard, vicariance must be understood beyond the idea of a linear substitution of vision through hearing or touch, assuming instead the value of a functional reorganization of experience, through which the subject constructs alternative pathways of access to the action and intentionality of the other (Berthoz, 2015; Sibilio et al., 2023). Visual impairment, read through this lens, thus becomes a theoretically fruitful condition for observing more clearly the plasticity of the perceptual and bodily systems that support empathic experience, especially in the processes in which the presence of the other is grasped through sensory configurations different from vision (Arioli et al., 2021).

It is here that the concept of vicarious sensoriality and of haptic and auditory perception becomes the fulcrum of a neural architecture capable of abstraction (Berthoz, 2015). Indeed, the mirror system seems to encode not only the physical image of movement, but also its teleological meaning and its affective charge.

In this regard, hearing may assume a vicarious function of particular importance in the construction of intersubjective experience, insofar as prosody, rhythmic variations in speech and the dynamic quality of sounds related to action offer decisive information for access to the intentional and emotional states of the other (Kohler et al., 2002; Gazzola et al., 2006; Ricciardi et al., 2009). The person with visual impairment, through a sensitivity progressively organized around voice and the sonority of action, can construct sensorimotor and socio-cognitive representations that participate in the understanding of the experience of others, within distributed and plastic networks, deeply shaped by the subject's perceptual history (Arioli et al., 2021; Berthoz, 2015).

Haptic perception is also of considerable relevance, since it could grasp the quality of the gesture, muscular tension and the direction of another person's action through contact or the shared manipulation of objects, integrating somatosensory information that converges in the parietal areas responsible for the representation of the body schema and action (Berthoz, 2015; Arioli et al., 2021).

From this perspective, accessible educational design may involve verbalizing spatial information and visually conveyed social cues, using prosody, rhythm and pauses, and also organizing spaces and interactions predictably. Integrating auditory, tactile, kinesthetic and verbal information, and offering choices among modes of exploration and participation would be desirable too. These conditions should be defined with students with visual impairment, whose experiential knowledge is essential for identifying useful forms of mediation. Indeed, they represent design ori-

entations and should be adapted to individual profiles and contexts (Sibilio, 2017; Sibilio et al., 2023).

5. Conclusions

In light of the reflections above, it is intended to highlight how empathy represents a fundamental competence in the construction of interpersonal relationships, configuring itself as a complex process that intertwines affective, emotional and neurobiological dimensions (Gentili et al., 2015). Indeed, as highlighted by the neuroscientific literature, empathy cannot be traced back to a single mechanism, but emerges from the interaction of neural networks involving sensorimotor, limbic and prefrontal systems (Arioli et al., 2021; Ricciardi et al., 2009). These are processes of multimodal integration that allow the sharing of emotional and intentional states. The analysis of empathy in the field of visual impairment could offer a particularly relevant contribution to this reflection, calling into question the idea that vision is the main sense for understanding the intentions and emotions of others.

In this regard, the importance of vicarious senses in empathic mechanisms appears evident. In conditions of visual impairment, indeed, hearing can support alternative access to others' emotional states, activating different neural networks capable of understanding the emotionality of another person.

Within this framework, it is possible to rethink empathy as grounded in a neural system that allows the internal simulation of the states of the other, enabling an immediate and pre-reflective understanding of their intentions and emotions (Gentili et al., 2015). This underlines how empathic resonance does not necessarily require visual access to the expressions of others, but can be mediated by auditory and bodily information, creating shared representations of experience (Ricciardi et al., 2009).

In conditions of visual impairment, vicarious senses - such as hearing, touch and kinesthesia - therefore assume a central role in the construction of empathic experience. The sound of actions, the prosody of the voice, the rhythm and dynamics of interaction allow the person with visual impairment to access the experience of the other through alternative sensory modalities (Sibilio, 2017; Sibilio et al., 2023), in line with the concept of vicariance, according to which the organism is able to replace one process with another in order to achieve the same objective (Berthoz, 2015).

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