Concepts, Language, and Early Socialization in the Indigenous Wichi Perspective: Toward a Relational–Ecological Paradigm

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Introduction

One of the crucial problems in most current approaches in developmental psychology has been the identification of the factors that explain development. This is an intellectual strategy originated in modern thought—the Cartesian-Split-Mechanistic worldview (Lakatos, 1978)—which sharply separates processes considered internal to the mind (innate dispositions, representations, etc.) from the external world (e.g., social determinations). As a result, "Cartesian psychology" is still facing unsolvable dichotomies such as nature versus nurture, development separated from evolution, child-centrism separated from culture, etc.

At the same time, there has been a rising movement toward an integrative developmental science based on relational thinking (Lerner, 2006, 2011; Lerner & Overton, 2008; Overton, 2006, 2010, 2012; Overton & Lerner, 2012). Generally speaking, this relational–ecological paradigm understands development in terms of the organism–environment econiche, encouraging attention to system-level dynamics rather than focusing on components in isolation. Centrally, the different theoretical versions within Relationism attribute the source of the change to the interactions of the system in question at those different dynamic levels, confirming its

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self-movement (Castorina, 2002). By focusing on development of interdependent elements as part of a system, this movement leads to the healing of the classic fundamental antinomies (e.g., subject–object, mind–body, nature–nurture, culture–individual) providing concepts that are inclusive and represented, not as pure forms, but as forms that flow across fuzzy boundaries (Overton, 2013a, b). Within the framework of this relationshipism, an alternative paradigm to Cartesian psychology—relational–ecological psychology—is opening up, in which a coalition of different perspectives and theoretical initiatives coexist, such as Developmental Ecological Psychology (Szokolszky & Read, 2018), Developmental Systems Theory (Oyama et al., 2001), Dynamic Systems Approaches (e.g., Lewis, 2010; Thelen & Smith, 2006), Sociocultural and Ecobehavioral Perspectives (e.g., Cole, 1996; Gauvain et al., 2011; Heft, 2001; Nelson, 1996; Rogoff, 2014; Valsiner, 1998), and Approaches on Embodied Intersubjectivity (e.g., Di Paolo & De Jaegher, 2016; Gallagher, 2005) (see Szokolszky & Read, 2018, for a detailed description).

We agree that ecological–relational psychology reveals strong possibilities for addressing the problems that the splitting Cartesian psychology has presented to the field of developmental science, in particular, the excessive focus on the causal factors that "explain or cause" development resulting in an individual child split from their context/culture. However, despite this important contribution, Cartesian rationality tracks are still found in developmental perspectives. The first is the overrepresentation of only one cultural group: children of middle-class European–American descendants (e.g., Gauvain et al., 2011). Second, even among the cross-cultural approaches, a bulk of studies often treat culture as a variable that influences, but is not constitutive of, the individual and development (see Mistry et al., 2013; Overton, 2013a, b).

In this chapter, we argue that these limitations, both methodological and epistemological, can be addressed bidirectionally: under the umbrella of the relational paradigm (Overton, 2013a, b) on the one hand and from evidence other than dominant populations—such as indigenous communities—on the other, populations that often happen to exhibit epistemological orientations aligned with the foundations of relational thinking. Different contributions from both Psychology and Anthropology have described indigenous epistemological orientations, that is, their way of knowing, as "relational epistemologies" (Bird-David, 1999; Medin et al., 1997, 2002, 2006, 2013, 2015; Pierotti, 2011). Briefly, these epistemologies are about knowing the world by focusing primarily on relatedness, developing the skills of being-in-the-world with other things (Bird-David, 1999).

In this work, we focus on two crucial developmental processes—concepts and language—from the Wichi perspective, an indigenous group living in the Chaco region in South America. First, we will describe their ways of knowing, attention to, and interaction with the world, identifying what aspects of their orientations make them relational epistemologies. Second, we will reconsider the Wichi relationality in light of our psychological evidence from two perspectives: (a) how Wichi children and adults conceptualize and reason about their environment, particularly about the *hunhat lheley* (inhabitants of the earth), and (b) how Wichi infants become native speakers and competent social participants of their culture. Finally, based on

this evidence, which, as we shall see, is well aligned with relational thinking, we will describe the emerging ecological–relational paradigm, which brings the relationshipism front and center.

The Wichi People: A Relational Epistemology on the *husek*

The Wichi are an indigenous community living in the Chaco Forest located in Northern Argentina (Fig. 1). We have focused on this population because they are an indigenous community with a strong native language, a constellation of experiences, and cultural orientations that differ considerably from those of Westerners (see Taverna et al., 2012 for a review). Interestingly, the Wichi language (*Wichi Lhamtes*, or "the words of the people") is the first language in the family and the primary language in the community (Taverna & Waxman, 2020; Vidal & Kuchenbrandt, 2015). Classified as a member of the Mataco-Mataguayan language

Fig. 1 Geographical setting of Wichi. Areas highlighted in gray identify Wichi communities as well as other indigenous groups of the Chaco Region

family (Tovar, 1964), this language has approximately 40,000 native speakers of Wichi in Argentina and Bolivia. In our research, we focus on the Wichi population living in Laguna Yema, Formosa, and Argentina, where the dialect known as del Teuco o Bermejo is spoken (Gerzenstein, 2003; Nercesian, 2014).

Anthropological documentations show that relationality among a great deal of species, environments (such as forests, rivers and lagoons), and "spiritual" beings are central to the Wichi (Palmer, 2005). This relationality is well captured by an overarching category *hunhat lheley* (inhabitants of the earth), which is composed of different inhabitants such as humans (the Wichi itself, the *siwele* or not Wichi people, and other ethnic groups) (Fig. 2), distinct animal categories (*tshotoy, tshotoy inot lheley, tshotoy fwiy'ohen, laloy*), several categories of plants (*hal'o, tokos,* etc.), and spiritual beings (*wuk, ahot*), all living in ecological habitats such as the "monte" (*tayhi*), domestic environments, and water habitats (*inot*) (Palmer, 2005; Suárez & Montani, 2010; Taverna et al., 2012). All *hunhat lheley* are perceived by the Wichi in the frame of a relational epistemology that is organized around the notion of *husek* (goodwill) as an agent of vitality and socialization. Several distinct kinds of *husek* have been noted (Palmer, 2005). First, *husek* invokes a notion of vitality (or "vital will"); thus, all *hunhat lheley*—humans, plants, animals, spirits, etc.—are related by means of this vital will (the blood, the greenness), which is absent in other entities (metal, stones, soil, etc.). Vital will is central to life processes as fundamental as growth, decomposition, and death. In addition, Palmer (2005) notes

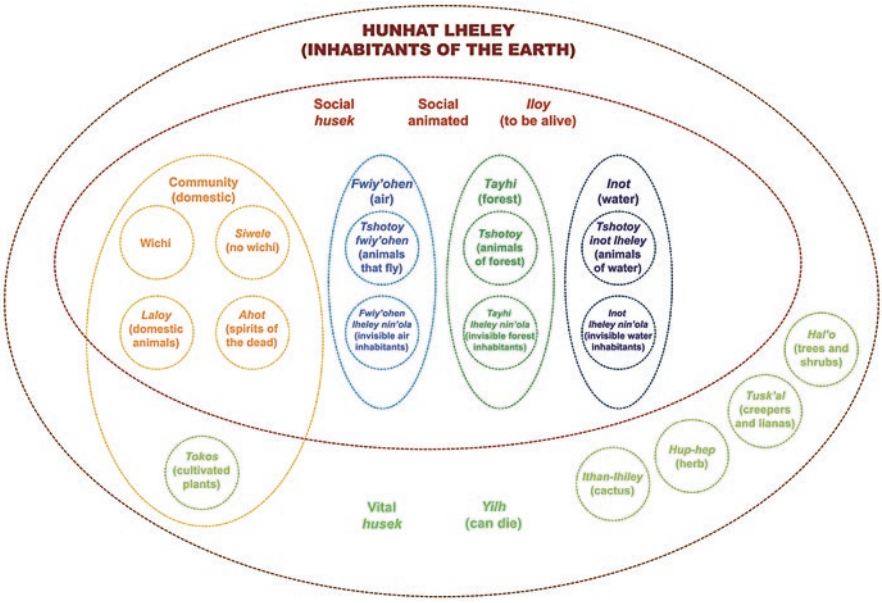

Fig. 2 Schematic representation of *hunhat lheley*. The colors indicate the different categories and environments. The dotted nodes indicate the categories and environments that are the subject of our current investigations

that *husek* also invokes a notion of socialization ("social will" or goodwill), which relates humans, non-human animals, and spiritual entities, but not to the plant kingdom (but see Suárez and Montani (2010) for a distinct interpretation for certain plants with animistic properties) and is deemed central to the process of socialization in the Wichi community. According to Wichi people, this agent defines socialization within the ecosystem. Socialization is a process in which "social *husek*" affects a transition from a natural, pre-social aggressive state to a more mature prosocial, peaceful one (Palmer, 2005). According to Palmer (2005) and our own native consultants, after a few months of life, human infants acquire social *husek*, reducing their natural pre-social aggressive tendencies and providing the social cooperation and pro-social behaviors required for membership within the Wichi community (Palmer, 2005). Thus, the *hunhat lheley* are perceived in their relational perspective, either from their vital will (vital *husek*) or from their social will (social *husek*). In what follows, we will show how this relationality shapes both, the representational means that the Wichi invoke when they reason about *hunhat lheley* and the language socialization and acquisition process that make the Wichi competent participants in their culture.

Concepts and Reasoning About *Hunhat lheley*

Concepts have commanded the agenda of cognitive and developmental sciences aligned with Cartesian psychology, occupying a prime position in research on the nature and representation of knowledge. Along with more recent approaches (Medin et al., 2013, 2015), in this chapter we argue that concepts should be considered in light of the cultural orientations in which they emerge. This position represents a shift from studies that have focused on concepts and categories such as whether they are acceptable or lousy examples of the category (e.g., Rosch & Mervis, 1975) or as part of universal theoretical frameworks such as folkbiology, folkpsychology, and folkphysics (for a more extended discussion, see Medin et al., 2013, 2015; Ojalehto & Medin, 2015; Ojalehto et al., 2017).

For over a decade, in our research program, we have adopted an ecological as well as an emergentist–constructionist approach with respect to how our cultural orientations permeate the conceptual systems which underlie knowledge across development (Medin et al., 2013, 2015; Taverna et al., 2020). Particularly, we have focused on how the Wichi, both children and adults, conceptualize and reason about *hunhat lheley* (inhabitants of the earth) (Baiocchi, 2019; Baiocchi et al., 2019; Fernández Ruiz, 2021; Fernández Ruiz et al., in press; Taverna et al., 2012, 2014, 2016, 2018). Here, we present this evidence organized on two cognitive processes: (a) categorization—how children and adults decide which entities are of the same type (Solomon et al., 1999); and (b) causal reasoning—how people perceive, represent, and reason about causality (Bender et al., 2017; Waldmann, 2017).

Categorization

One of the key cognitive processes in conceptual representation is categorization, the process by which people decide which entities are of the same type (Murphy, 2002; Smith & Medin, 1981; Solomon et al., 1999). Particularly, concepts and categories about the natural world have been pervasive in the developmental sciences, with decades of work dedicated to identifying the conceptual frameworks (taxonomic, thematic, functional ecological) and core concepts (e.g., animate, living things) that children use to organize and reason about nature (Margolis & Laurence, 2015; Murphy, 2002; Smith & Medin, 1981). In our pioneering studies in this community (Taverna et al., 2012, 2014, 2016, 2018), we focus on this process, studying through classification and reasoning tasks, how Wichi children (5–6-year-olds, 10–11-year-olds) and adults decide which inhabitants and/or entities "are alive" (*iloy)*, "can die" (*yilh*) and share *husek* (social, vital will) and how these attributions permeate the way they reason about the relationships among inhabitants and entities (people, animals, plants, artifacts, etc.) (see Table 1 for the proportion of *husek* attribution as a function of each inhabitant or entity; Taverna et al., 2012). We found clear findings: (a) only the Wichi and animals—but not plants—possess *iloy* (to be alive) reflecting an animistic perspective on life; (b) nevertheless, the three inhabitants—Wichi, animals, and plants—can *yilh* (to die); (c) both living categories—humans and animals—are equally central in their epistemology, rejecting any anthropocentric perspective in reasoning (Carey, 1985, 2009); (d) the social *husek* is attributed to humans and animals—but not plants—emphasizing pro-social intentions and animistic behaviors between them; (e) these patterns were found rather early in childhood, showing that the influence of the Wichi cultural orientations are sufficiently strong to maintain access to the animate interpretation of alive (*iloy*) across development.

Based on those findings, more recently (Baiocchi, 2019; Baiocchi et al., 2019), we ask how Wichi children (5-year-olds, 10-year-olds) and adults conceptually

Table 1 Proportion of *husek* attribution for each inhabitant/entity

Test item	*M*
Human	0.94
Jaguar	0.82
Dog	0.82
Snake	0.82
Vinchuca (*Triatoma infestans*)	0.76
Mosquito	0.82
Bottle tree	0.29
Cháguar (*Bromelia* sp.)	0.17
Sun	0.05
Chair	0

Reproduced from Taverna et al. (2012)

organize the animals of the Chaco Forest, *tshotoy*.[1] All of them were asked to do a sorting task used in previous studies (Bailenson et al., 2002; López et al., 1997; Medin et al., 2006), adapted to the native perspective and the Wichi language. The participants, after identifying each animal, had to group the 41 photographs of *tshotoy* (see Fig. 3) in numerous rounds of classification, according to how they thought and argued "the animals were in nature." On every round of sorting, participants were free to form as many groups as they wished (see Baiocchi et al., 2019 for a detailed description of the task).

Three important findings were obtained about how the Wichi represent and conceptually organize *tshotoy*. First, we identified an ecological organization—not taxonomic (e.g., mammals, reptiles)—among *tshotoy*, based primarily on interactions among the animals of the Chaco forest. The distance among *tshotoy*, that is, how close and how far they are in the Wichi ecosystem, was defined primarily by specific ecological relationships and rarely by taxonomic ones (e.g., the morphological

Fig. 3 Complete set of photographs used in the study, in alphabetical order with each animal labeled with its scientific name

[1] *Tshotoy* is made up of various species of mammals and reptiles (among others). As such, this animal category, which is imbued with powerful cultural significance because the Wichi identify themselves as descendants of *tshotoy*, provided an opportunity to examine the salience of taxonomic similarity (e.g., morphological or other perceptual commonalities among *tshotoy* like species, kind, size) and Wichi ecological frameworks about the organization of the animals of their ecosystem (e.g., food chain, habitat, social relations, utility to humans).

similarity between animals). Second, in this ecological organization, we observe that the Wichi classify the animals as aggressive (e.g., snakes, cats, "they are dangerous, they can attack each other and the rest of the animals, can attack people") away from the peaceful ones (e.g., armadillos, cows, rats, pigs, "they are defenseless animals, they live together without problem, you find them anywhere"). In addition, aligned with this organization, the Wichi formed subgroups based on other ecological principles (e.g., utility of animals, habits, food chain, habitat).

We co-interpret these classifications based on a socioecological principle that emphasizes the relationships of sociability vs. (pre-social) aggressiveness on the basis of which peaceful, defenseless friendly animals would be conceptually different from aggressive, dangerous hostile ones (Baiocchi, 2019; Baiocchi et al., 2019). These findings challenge universal postulates (e.g., Berlin et al., 1973, 1974; Osherson et al., 1990) since the Wichi adults did not show taxonomic relations as a priority to organize *tshotoy;* instead, they showed culture-specific principles in the conceptual organization of the animals of their native forest. In addition, when analyzing the sorting through development, we observed that this socioecological principle (peaceful vs. hostile animals) is already present in 5-year-old children and progresses with greater specialization as age advances. For 5-year-old children, all *tshotoy* are aggressive, for 10-year-olds, *tshotoy* are simultaneously aggressive and peaceful, while in adulthood the aggressive animals are far away from the peaceful ones.

Causal Reasoning

Causal reasoning is a central cognitive process of human cognition through which people perceive, represent, and reason about causal events and their interactions (Bender et al., 2017; Waldmann, 2017). Recent research explored causal representations and framework theories of Wichi people when they reason about causal relationships between agents, entities, and environments of their native ecosystem (Fernández Ruiz, 2021; Fernández Ruiz & Taverna, in prep.). Based on open interviews with key consultants and articulating the previous anthropological and ethnobiological evidence (Arenas, 2003; Montani, 2018; Palmer, 2005; Suárez, 2020), we focused on ecosystem events because they are rich in relationships and involve different types of entities characterized by complexity, emergent processes, and circular causality. As a result, we first identified *hunhat lheley*, entities, properties, and native features that make up the most significant events of the Wichi ecosystem from the perspective of their native speakers. On the basis of these insights, in a following stage, we explore causal reasoning among the Wichi, focusing on two dimensions: (a) the *type of causes* (*natural*, *supernatural*) that the Wichi invoked when they reason about the *hunhat lheley*[2] and (b) the relationships between *native*

[2] Since ethnographic background documented that Wichi people do not categorically differentiate between "natural" and "supernatural" beings, we tested empirically the validity of these assumptions, showing an intimate relationship between "spiritual" and biological worlds (Palmer, 2005; Suárez, 2014).

features of *hunhat lheley* (*husek*—will; *inot*—water; *nin'ola*—invisible) and *ecological levels* (*inhabitant*, *environment*, *annual climate cycle*) from which causes come. To study this, we employed a causal attribution task adapted to the Wichi epistemology and their language. In this task, participants were asked to infer the causes of 38 events that represented different common phenomena among *hunhat lheley* (humans, animals, plants, and non-human beings), environments (forest, lagoon, etc.), and other entities of their ecosystem (e.g., inert matter) (e.g., "master spirit of forest is angry," why do you think this happens?) (Table 2). The events were accompanied with images of native animals and plants extracted from the books "*Hunhat Lheley*" (inhabitants of the earth), prepared by Wichi speakers and members of our team (Pérez et al., 2017a, b, c, d, e, 2021).

Results confirmed our hypothesis that the Wichi people attributed "natural" causes (e.g., food) to all *hunhat lheley* and entities, even those considered "supernatural" by the Western ontology (e.g., master spirit of forest), evidencing that these latter are ecosystem's inhabitant like any other. In addition, Wichi people were more likely to attribute causes of the inhabitant level (e.g., mood) to *hunhat lheley* with social *husek*, but causes of the annual climatic cycle level (e.g., rains) to *hunhat lheley* and entities without social *husek*. They were also more likely to attribute causes of the environment level (e.g., lagoon pollution) to aquatic *hunhat lheley* and entities—*inot*—, rather than to *hunhat lheley* and entities that live on land or in the air.

Table 2 List of events of Wichi ecosystem used to study causal reasoning

Events	
Carob tree grows	*Master spirit of forest dies*
Carob tree bears fruits	*Master spirit of water grows*
Carob tree is sick	*Master spirit of water is angry*
Carob tree is dry	*Master spirit of water is sick*
Chaco chachalaca grows	*Master spirit of water dies*
Chaco chachalaca flies	*Wichi cuts a carob tree and then grows*
Chaco chachalaca sings	*Wichi hunts*
Chaco chachalaca is sick	*Wichi drowns in lagoon*
Chaco chachalaca dies	*Wichi fishing*
Fish grows	*Wichi grows*
Fish swims	*Wichi is angry*
Fish is sick	*Wichi is sick*
Fish dies	*Wichi dies*
Fruit is delicious	*Wood floats*
Lagoon is dry	*Wood falls*
Lagoon has fish	*Yacare caiman grows*
Master spirit of forest grows	*Yacare caiman swims*
Master spirit of forest is angry	*Yacare caiman is sick*
Master spirit of forest is sick	*Yacare caiman dies*

Reproduced from Fernández Ruiz (2021)

From results emerged a native framework for causal reasoning with three interactive causal principles: *relational*—all inhabitants, "natural" and "supernatural," are connected; *socioecological*—the distinction between animate–social *hunhat lheley*—social *husek*—and inanimate–pre-social entities; *environmental*—the distinction between aquatic *hunhat lheley*/entities—*inot*—and nonaquatic. These causal principles could delimit different domains to the supposedly universal domains of Cartesian psychology (folkphysics, folkbiology, and folkpsychology). For example, aquatic environments and their inhabitants could constitute a potentially different domain, made up of physical entities (e.g., lagoon, river), biological beings (e.g., fish), and "supernatural" beings (e.g., master spirit of water), establishing specific domain limits of this ecological human group.

In sum, the findings on concepts and reasoning among the Wichi strengthen the relational perspective on conceptual development (Medin et al., 2013, 2015; Taverna et al., 2020), showing how cultural knowledge permeates the conceptual system—conceptual representations and processes—throughout development. Within the relational epistemology of the *hunhat lheley*, these inhabitants are perceived in their relational perspective, either from their vital will (vital *husek*) or social animistic will (social *husek*). These two relational perspectives, evident in their belief system, shape the Wichi's conceptual representations about living things (*iloy*), animate (social–animist *husek*), and animals (pre-social–aggressive *tshotoy* vs. social and peaceful ones) and the type of causes the Wichi invoke in explaining the behavior of the inhabitants and entities of their ecosystem ("all inhabitants, even "supernatural ones" are affected by natural causes"). In addition, certain relevant environmental features of the *hunhat lheley* (e.g., belonging or not to an aquatic environment) also affect their causal reasoning. Many of these culturally specific conceptual patterns emerge at early stages of childhood (e.g., the ecological character of *thsotoy*), changing with greater specialization as age advances. Precisely, the interactions of the learning system at different levels—epistemological orientations, representational resources, cognitive processes—are those that drive changes within the system in question and its conceptual representations. That is why the Wichi perspective, strongly aligned with the relational–ecological paradigm (Overton, 2013a, b; Read & Szokolszky, 2018), challenges the Cartesian-divided-mechanistic worldview that sees child's mind separated from the context/culture and development as a result of causal factors, providing interpretations that explain representational emergence and cultural knowledge synergically.

Language Acquisition and Early Socialization in the Wichi Language

Language acquisition, and more specifically that of grammar, is a pampered subject within developmental science as it is a formal development produced by a prelogical cognitive system that is observable in the child's production behavior (López

Ornat, 1999; for a review of this discussion, see MacWhinney, 2004). However, most of the studies on language acquisition on which the current psycholinguistic theories are based have been carried out with Indo-European languages and in speaking communities that usually belong to the Euro-American middle class urban cultural model (see De León Pasquel, 2005, 2012). Regarding the Wichi, there is an absence of the documentation on the acquisition of the great variety of indigenous languages during childhood that exist in this area of our country (except for recent studies on Qom/Toba language (Audisio et al., 2021)).

In this context, the study of the acquisition of grammatical knowledge in the Wichi, a polysynthetic and agglutinating language, is central. According to the constructivist–emergentist perspective (López Ornat, 1999), the grammatical knowledge is a logical system that emerges and is formed in and by the learning task and is acquired during and due to the acquisition process. In this frame, since the acquisition of grammar occurs in the human environment, the child is socially and simultaneously exposed to the linguistic forms and the referents of their meanings within the language learning task (López Ornat, 1999). Consequently, the problem of language acquisition in Wichi is addressed along with the properties of the environmental language being acquired in conjunction with the early socio-cognitive competencies that emerged in social interaction.

Our methodological approach consists mainly of corpus data. It consists of 101 hours of video recordings of 16 children from two cultural groups (Spanish-speaking from urban context and indigenous Wichi from Chaco Forest) in their natural environment at different points of development during their first 4 years. This corpus was gathered in the framework of an intense fieldwork carried out in the Wichi Lawet community, Laguna Yema, Formosa, and with Spanish-speaking families from the city of Rosario, Santa Fe, between the years 2012 and 2017 (Taverna et al., 2020; Taverna, 2021).

Coordinating Attention and Mental State Attributions in Caregiver–Infant Interaction

The study of the mind has been conceived under biology and sociology as divided realms; also, the mind has been assumed as imperceivable and opaque to others in the early stages of development (Szokoloszky & Read, 2018). It is not until around the first year that a crucial developmental change occurs: infants understand others as intentional agents who can direct their (infants') attention and whose attention can, in turn, be directed by an adult, and thus share communication about objects or events in the world. Semiotic resources for drawing an interlocutor's attention everywhere include speech, gaze, body touching and postures, pointing gestures, and other actions. In turn, adults deploy a series of resources as well, ones that allow them to interpret and attribute intentions to the significant actions that infants

perform. The issue is whether adults deploy semiotic resources in comparable ways with infants in different settings.

In an ongoing set of studies, we address this question by seeking evidence of the process through which mother–infants from the two cultural communities under study—Wichi and Spanish-speaking infants and their families—come to be able to coordinate attention and mental states attribution within social interaction. We focus on the infant's bodily manifestations, movements, and gaze patterns and those directed toward the infant. For its analysis, based on the Constant Comparative Method (Strauss & Corbin, 1990), we encode semiotic body forms directed toward and from the infant, encoding the gaze pattern and identifying different categories that describe an attentional gradient of the interaction participants. This procedure allows us to know how attention is organized in these interactions cross-culturally (Taverna & Padilla, 2020).

Preliminary results show that unlike mothers from other indigenous communities studied to date, who tended to develop a less child-centered profile (Schieffelin & Ochs, 1986), Wichi mothers tend to focus their attention on the child. However, in contrast to Spanish-speaking communities, joint attention episodes seem to be scarce. Interestingly, Wichi caregivers—but not their Spanish-speaking counterparts—tend to display a sustained attentional ability when infants are interacting with objects or events in their environment, intervening only if necessary (Taverna & Padilla, in prep.). Based on these first results, we hypothesize that this sustained generalized and outstanding observational "talent" of the Wichi mothers when the child is interacting with objects could configure a cultural-specific triadic attentional modality—child–object–mother or caregiver—one in which the caregiver coordinates her attention by offering it and enabling it to the child with a more "lateral" (Clark, 1996; De León Pasquel, 2005) and less interventionist participation. We propose to call this culturally specific engagement pattern "affordance attention," in which shared attention and speech would not be compulsory, although the attentive presence of the caregiver would be.

In the frame of these engagement formats, we are also exploring how caregivers are Mind Minded (Meins et al., 2001) to infants cross-culturally. To accomplish this, we first interactively analyze the speech and actions directed at the infant, seeking to detect actions, verbalizations, and gestures of the mother as indicators that she is interpreting motivations, intentions, wishes, and propositional attitudes of the infant (Pérez & Español, 2014), and not only through mentalistic comments (Mind Mindedness) (Meins et al., 2001), which is the common perspective in the studies conducted in the field. So far, we have obtained two important results: (1) the Mind Mindedness (MM) construct is being revisited; (2) a multimodal and culturally sensible category system was built for the analysis of the Maternal Mental States Attributions (MMSA) with subcategories aimed to identify how the mother (or caregiver) attributes motivations, intentions, wishes, and propositional attitudes to the infant and how it occurs (Table 3).

Results are a novel set of categories that integrate smart social perception, context, an expansion from the dyad, and shared bodily awareness and understand mentalistic interactions embedded in system-level dynamics rather than its components

Table 3 Set of observational categories for the analysis of the Maternal Mental States Attributions

Category	Definition	Examples
Mental state interpretation Mentalistic Interaction (I) No Mentalistic Interaction (NI)	An adult or peer attributes wishes, beliefs, or intentions to a target infant	The caregiver sees the infant reaching for an object and hands it to him/her and says "*is this what you want?*"
Modality Verbal (VI) Corporeal (CI) Multimodal (MI)	The semiotic modality of a mentalistic interpretation	Verbal: the caregiver says "*don't touch that*" while the infant is reaching for an object Corporeal: the caregiver physically removes the infant before he or she touches the object Multimodal: is a combination of the verbal and corporeal modalities
Direction Child directed (CDI) Overheared (OI)	That is to whom the mentalistic interpretation is directed	Directed: the caregiver asks the target infant what he/she wants Overheard: the caregiver asks another person in the room what he/she wants
Source Mother (Ma) Other adult (Oa) Other Child (Ch)	Who is attributing the mentalistic behavior	The caregiver says "*don't touch that*" (source) and the infant retreats
Executor Mother (Ma) Other adult (Oa) Other Child (Ch)	Who enforces the mentalistic interaction	From the previous example: another person removes the infant before it touches the prohibited object
Type of Discursive Strategy	The type of pragmatic statement that is used in the mentalistic interpretation (Taverna, 2021)	
Prescriptive	*Warn*: negative, harmful consequences//kelh	*Suwanas tajlhy* (Come, there are ants)
	Order: directives that tend to regulate the child's action	*Yajlhek* (Don't go)
Referential-denotative	*Establish reference:* draws attention to entities, environmental situations	*Wepa neche* (Listen to the seriema)
	Name: entities, people, or situations	*Catita* (Parrot)
Conversational	*Affirm-deny:* verbal and gestural	Yes/No expressions or nods
	Comment: situations, events, objects, actions	*Am ka huyey escuela* (You don't go to school)
	Encourage: proposes and encourages the performance of actions	*Tsiteyej hulu tolothila* (Play with the earth, there you have the cup)
	Question: about states, emotions, actions	*¿Lawenhe Tito?* (Did you sew Tito?)//*¿Tenlo inot?* (Do you want water?)

in isolation (Rietveld & Kiverstein, 2014). Precisely, within relationism, analysis is about creating categories, not about cutting nature at its joints (Overton, 2013a). Moreover, by developing an observational coding system based on the data corpus itself, instead of applying an external coding system, we could not only identify the specific semiotic resources—speech, gaze, touch, body postures, gestures—used by caregivers from populations under study but also how these resources are combined in novel interactive configurations that serve to coordinate attention and mental state interpretations in mother–infant interaction at the different target cultural settings.

The Acquisition of the Wichi Language: First Outcomes

Previous studies in morphologically complex languages are not very numerous (for a review, see Kelly et al., 2014) but within the available evidence the focus is fundamentally on the learning mechanisms that are put into play in the process of acquisition of these languages, which are presented to the infant as a real puzzle (Peters, 1981). Our ongoing longitudinal research seeks precisely to generate the first psycholinguistic evidence in this native language. Particularly, we focus on the grammaticalization process, that is, the transition between the first pre-grammatical verbalizations to the simple but completely grammatical productions.

Our preliminary results show changes in children's Wichi speech productions and in the properties of the linguistic information to which infants are exposed. Both changes delineate a clear evolutionary trajectory, one that goes from a pre-grammatical stage toward the emergence of grammatical or morphosyntactic knowledge. At the monomorphemic period (MLU (Mean Length Utterance) =1), infants seem to produce mostly nominal and verbal stems stripped of affixes, and nominal stems outstrip verbal ones in children's vocabulary, even though the number of verbs far outstrips the number of nouns in the adult input. More precisely, when the MLU barely exceeds 1 (1.05–1.17), nominal and verbal affixes (type and token) represent only 4% of the total number of nouns and verbs produced in this period.

At the same time, at this pre-grammatical stage, a "motherese" or a stable speech register employed by mothers (and other caregivers) when addressing young children in this culture was identified (Taverna, 2021). The Wichi "motherese" was characterized by a constellation of prosodic, lexical, and pragmatic-discursive features showing differences and similarities with the ones observed in other linguistic communities. First, in contrast to baby talk from dominant linguistic populations, prosodically the Wichi "motherese" shows the same normal tone as in adult–adult interactions. Second, a set of nine Wichi baby talk lexical items were discovered that thus far had not been captured in the literature on this language. Semantically, these are terms equivalent to those of adult speech that refer to aspects of interest to the child (see Table 4). In addition, at a discursive-pragmatic level, the Wichi "motherese" at the pre-grammatical stage focused on discursive strategies with directive

Table 4 Wichi baby talk, semantically organized with its equivalent adult term in Wichi and English

Baby talk	Adult term	
	Wichi	English
Entities and people		
Chuku	*Asinoj*	Dog
Lulu	*Tulu*	Cow, meat
Tata	*Lafwcha*	Dad
Titit		Little car
Toto		Toy
Emotional states		
Kuku	*Nuway*	To feel scared
Nana	*Oytaj*	To feel pain
Basic needs		
Chichi		Maternal breast
Mimi	*Inot*	Water

Reproduced from Taverna (2021)

functions (prescriptions and/or denotations). For example, a group of prescriptive strategies in the here and now are characterized by orders referring to concrete actions (1050: *yajnencho* [don't come down]), prescriptions in the near future in the form of warnings (1006: *che suwele hin'am* [the non-Wichi person is watching you]), and denotations that label objects or events in the child's surrounding world. This "labeling" function ranges from names of objects of interest to the child (1058: *titit* [little car]) through the use of Spanish loans (2037: *jutu* [foto—photo]) to names that denote people (5249: *siwele* [non-Wichi person]) and animals (5018: *cheche* [parrot]//5232: *neche* [seriema].

When infants reach an MLU of 1.5, the number of verbal stems (both type and token) increases, so children's early noun-advantage characteristic of the previous period decreases and comes into closer alignment with the patterns in the linguistic input. At this stage, as the number of verbal stems increases, so do the number of verbal and nominal affixes that encode the grammatical categories that characterize the morphology of both nouns and verbs in Wichi. In fact, at this point of development, both nominal and verbal affixes represent 20% of the total of the nouns and verbs, five times more than the previous period. So, as soon as children approach an MLU of 1.50, there is an increasing productive command over the grammatical categories often expressed in Wichi morpho-syntactically within the word level for both nouns (e.g., possession, deixis, augmentative, etc.) and verbs (pronominal pronouns, mode, etc.), emerging the first combinatory morphosyntactic forms (see Taverna & Waxman, 2020, for a more detailed description of the emergent grammatical categories at this phase).

Regarding the "motherese" at this stage, during the beginning of the combination of morphemes (M = 1.5 and beyond), maternal speech shows discursive strategies

that compose more elaborated functions than those from the previous stage, so conversational routines or proto-conversations emerged. Thus, among the most frequent discursive strategies, we observed comments, which tend to denote "showing the world" that surrounds the child (Tsep) (5260: *hin we suwanas* [look at the ants]//5218: *neche wepan we* [listen to the seriema]), interrogatives (Dqst) (5070: *¿apihi Norberto?* [where is Norberto?]), responses to questions from the young child (Drsp) (5209: *chayhu* [it's hot]), and assertions and/or negations (Dan) (1130: *is* [Good]//1005: *kha* [no]) in the context of events situated in the present and related to the child's surrounding world (Tsep).

Overall, infants from all the world's languages are expected to acquire their environmental language at any point between their 18 months and three and a half years. Predicting how grammatical knowledge of the language under acquisition will develop means to show how the language learning system uses what information (social, cognitive, linguistic, etc.) and, also, how both (information and system) change as a result of the acquisition process until they become a grammatical knowledge system. The first responses to the Wichi acquisition problem show qualitative changes both in the child language—from a pre-grammatical period toward first morphosyntactic combinations—and in certain aspects of the socialization process, the maternal speech, "motherese" Wichi. This linguistic transition occurs in a social environment, one that would be characterized by a child-centered context, in which mothers, instead of engaging children exclusively in joint attention formats, seem to coordinate attention in a culturally specific fashion creating "attentional affordances" episodes, where speech and joint gazes would not be compulsory, and mothers will intervene only if it is necessary (Taverna & Padilla, in prep.). When and how Wichi infants' speech becomes grammatical is still a matter of our current research efforts. Both knowing (process) and known (products) are considered as equal and indissociable complementary processes in the construction, acquisition, and growth of knowledge, in this case, the Wichi grammatical knowledge.

The Wichi Perspective and the Relational Turn on Developmental Science

Our work on thought and language across development among the Wichi reveals the power of relationshipism in two cross-fertilized native-scientific epistemological directions.

From the native toward the scientific path, the discovery of the mutual and synergistic relationship between the emerging Wichi representational resources and their native epistemology (commonly viewed as mental-cognitive vs. external and contextual polarities in Cartesian psychology) took us toward the adoption of relationism as a paradigm with three main characteristics. First, the different polarities (e.g., mind/culture, learning-system/context, etc.) are not considered exclusive contradictions as in the split epistemology but as differentiated polarities (e.g.,

co-iguals) of a unified inclusive matrix of relations, each pole defines and is defined recursively by its opposite (Overton, 2013a). Second, in order to set a positive agenda for empirical inquiry, opposites (e.g., conceptual and language-learning systems vs. cultural orientations, lingüistic input) are considered levels of analysis, the focus of attention, in recognition that they do not neglect absolute foundations (Latour, 1993, 2004) but perspectives in a multiperspective world (Rogoff, 1992). In the third movement, a new "middle space" (Overton, 2013a), which Latour (1993, 2004) called "the middle kingdom position", away from the extremes of the Cartesian splits is created to then discover a novel system—a synthesis—that will coordinate the two-only conflicting polarities. For example, in this middle position, the language learning system and the different interacting levels (social, cognitive, linguistic, etc.) change as a result of the acquisition process.

Under the umbrella of this relationism, the constructionism–emergentist perspective on language acquisition (López Ornat, 1999) as well as recent cognitive-ecological accounts on concepts (Medin et al., 2015) constitutes theoretical approaches under which we framed our research among the Wichi. Within these perspectives, key notions such as econiche, affordances, and representational emergence work as crucial entry points.

The term "ecological," increasingly popular in recent years used in several different contexts (Jensen & Greve, 2019), emphasizes the profoundly relational character of entities or elements in the world. Within the cognitive-ecological approach on concepts and conceptual representations (Medin et al., 2015), it is believed that, like some species in an ecosystem, certain ideas may grow better in certain ecologies than in others, persisting and achieving a widespread distribution. In addition, these stabilized "ideas-habitats" might work as "cultural affordances" (Ramstead et al., 2016). Typically understood as possibilities for actions the environment offers to a creature (such as reaching, grasping, sitting, walking, and so on) (Gibson, 1979/1986), the affordance construct is fundamentally interactional. In a recent sociocultural understanding of the concept (Ramstead et al., 2016; Rietveld & Kiverstein, 2014; and see Chemero, 2003; Costall, 1995; Costall & Richards, 2013; Heft, 2017; Michaels, 2003; Withagen & Chemero, 2012) taking Gibson's (1979/1986) ideas and applying it to the human econiche, cultural affordances are precisely those stabilized cultural cues (cultural knowledge, values, socialization and linguistic practices, etc.), which constitute different behavioral patterns (or forms of life) that characterized particular groups relatively robust on sociocultural time scales, and acquired through sociocultural processes such as joint-intentionality or shared-expectations, cultural conventionality, and perspective-taking abilities (see Ramstead et al., 2016). The ecological niche is, then, a network of interrelated cultural affordances. At the learning-system (conceptual and language system) level, the recursive interaction between the system in question, the learning mechanisms, and the cultural affordances in each human econiche (practices, values, cultural knowledge, etc.) are those that drive changes at the representational resources within the learning system synergically.

Finally, from the scientific toward the native direction, relationism and its three key concepts—econiche, affordances, and representational emergence—have

illuminated the Wichi ecosystem as an ecological niche made up of interconnected cultural affordances, relatively widespread and robust within the population. The *hunhat lheley*, *tshotoy*, spiritual inhabitants, and the Wichi itself coexist fully integrated with the Chaco forest, and it is precisely the Wichi cognitive (e.g., categorization, causal reasoning), linguistic and social competencies as stabilized behavioral patterns that contribute to building this native organism–environment econiche as it is. Likewise, it is his human organism–environment econiche that offers an open system of stabilized cultural cues or "cultural affordances" (the *hunhat lheley* notion and its epistemological orientations as well as the environmental language and its referents/meanings/forms, socialization, cultural practices) based on the specific competencies of this forms of life, what shapes, in conjunction with general learning mechanisms, the acquisition, and developmental processes.

Certainly, these insights are far from new. First of all, they are in line with the developmental ecological psychology and a "coalition" of relational–ecological developmental theories, which from a different epistemological and theoretical basis, all focus on an anti-dualistic agenda for the field of developmental science (see Szokolszky & Read, 2018, for a detailed description). The cross-fertilization among these disciplines and perspectives is an indispensable effort for the full realization of the relational–ecological turn in development. In this enterprise, addressing one remaining challenge is urgent: overcoming the over-representation of the Anglo-speaking children of middle-class European American descent and including a broader range of cultural childhoods. In our case, both conjugated relationshipisms, the native and the scientific, pushed us toward the anti-dualist epistemic framework (Baiocchi et al., 2019; Fernández Ruiz, 2021, in prep.; Taverna, et al., 2020). The active synergy between ecological psychology (econiche, affordances), constructionism–emergentist perspectives (learning-system, representational emergence), cultural–cognitive approaches (ecosystem, epistemological orientations, cultural practices), and the relational epistemology of the hunhat lheley (Wichi perspective) collaborates in an open and evolving movement that seeks and finds interactive conjunction of new insights. We are on that way.

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