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THEORETICAL ARTICLE

A Review of Relational Frame Theory Research Into Deictic Relational Responding

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Abstract Relational frame theory (RFT) is a modern behavioral approach to human language and cognition that accounts for complex human behavior, such as perspective taking in terms of derived relational responding. According to RFT, a history of reinforcement for relating deictic relations, such as I–you, here–there, and now–then, may lead to the emergence of a sophisticated repertoire of perspective taking. This theoretical understanding of complex behavior has resulted in the design of interventions to establish these repertoires when deficient. This study analyzes the contributions made to date by the *deictic relations approach to perspective taking in typically and atypically developing children and adults*. A total of 34 articles published between 2001 and 2015 were selected (26 empirical and 8 nonempirical). The results indicate an expansion of empirical evidence into deictic relations. However, there is still a need for empirical work on its application to atypical development and clinical populations. Future research directions are discussed.

Keywords Relational frame theory · Deictic relations · Review · Perspective taking

Relational frame theory (RFT; Hayes, Barnes-Holmes, & Roche, 2001) is a contemporary behavior-analytic account of human language and cognition. It facilitates the analysis and understanding of complex behavioral phenomena that have traditionally been the purview of cognitive psychologists, such as empathy, self-concept, intelligence, or creative behavior (Cassidy, Roche, & Hayes, 2011; Dymond & Roche, 2013; McHugh, Barnes-Holmes, & Barnes-Holmes, 2004a; McHugh, & Stewart, 2012; O'Toole, Barnes-Holmes, Murphy, O'Connor, & Barnes-Holmes, 2009). According to RFT, humans are able to respond relationally to objects or events when the relation is not defined by the physical properties of the objects but rather by contextual controlled cues (for a more complete account, see Hayes et al., 2001). For example, if a child learns that "A occurs before B," then he is able to say that "B occurs after A" without any further training. This response is controlled by the contextual cues *before* and *after*, but not by any physical relation. Particular kinds of relational responding are called *relational frames*.

From the RFT point of view there are several such frames, including coordination (identity, sameness, or similarity—i.e., A is equal to B); opposition (A is the opposite of B); distinction (responding to one event in terms of its differences with another event); comparison (e.g., A is worse/better than B); hierarchy (e.g., A is an attribute of B); temporality (e.g., A occurs before B); spatiality (e.g., A is below B); conditionality and causality (cause–effect relationships established between events, the form "if . . .then . . .") and deictic relations (specifying a relationship in terms of the perspective of the speaker—e.g., "I–you", " here–there," and "now–then").

RFT provides a theoretical framework for the understanding of many facets of complex human behavior. Research shows that performance on relational responding tasks correlates with normal language and cognitive development and that deficits in the former have been found in developmentally delayed populations (Hayes et al, 2001; O'Hora, Pelaez, & Barnes-Holmes, 2005). In the 14 years since the first RFT book (Hayes et al., 2001), a growing body of research has indicated the importance of relational framing in development

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as well as the possibility of training it when deficient (see, e.g., Dunne, Foody, Barnes-Holmes, Barnes-Holmes, & Murphy, 2014; Luciano, Gómez-Becerra, & Rodríguez-Valverde, 2007; Rehfeldt, & Barnes-Holmes, 2009; Walsh, Horgan, Jay, Dymond, & Whelan, 2014). Therefore, empirical intervention guided by RFT may generate new procedures for establishing relational skills aimed at overcoming language deficits in applied populations. In line with this suggestion, Rehfeldt and Barnes-Holmes (2009) developed a book-length account of a number of RFT training protocols for learners with developmental disabilities that target basic and complex cognitive skills. Furthermore, empirical studies have demonstrated the utility of considering RFT when designing and developing therapeutic interventions, such as acceptance and commitment therapy (ACT; for full details, see Hayes, Strosahl, & Wilson, 1999; Luciano, Rodríguez-Valverde, & Gutiérrez, 2004). In short, ACT is a clinical behavioral approach to psychotherapy that coheres with the RFT analysis of human language and cognition (Hayes et al., 2001).

According to RFT, deictic relational frames have been able to explain cognitive concepts such as *theory of mind* (ToM; concept initially appeared in Premack & Woodruff, 1978) and perspective taking (for a cognitive and structural-developmental approach, see Selman, 1980). From an RFT point of view, perspective taking involves a complex pattern of relational responding in accordance with I–You, Here–There, and Now–Then "deictic" cues, which are manipulable environmental variables. Such deictic cues are learned from a history of multiple exemplars of asking and responding to questions such as, "What am *I* doing *now*?", "What did *you* hear *there*?", or "Where were *you* singing *then*?" Each time these questions are answered, the physical properties of the environment will be different. However, the relational properties of I–you, here–there, and now–then remains constant across all exemplars (Hayes et al., 2001). That is to say, these frames that specify a relation in terms of perspective of the speaker do not appear to have formal (i.e., nonarbitrary) counterparts and therefore cannot be traced to formal dimensions in the environment (McHugh, Stewart, & Hooper, 2012).

In the experimental research conducted so far, deictic relations have been divided into three levels of complexity: simple, reversed, and double reversed (McHugh, Barnes-Holmes, & Barnes-Holmes, 2004b). In a simple relational response, none of the elements are reversed—for example, "I (experimenter) am sitting here in a blue chair and you (subject) are sitting there in a black chair. Where are you sitting?" In a reversed relational response, one of the relations is reversed—for example, "If I were you and you were me, where would you be sitting?" And a correct response reflects this relational reversal (i.e., the experimenter is sitting in a black chair and the subject is sitting in a blue chair). In a double reversed relational response, two relations are reversed simultaneously (e.g., "If I were you and you were me and if here were there and there were here, where would you be sitting?"), and a correct response would appear to require more complex derived relational activity (i.e., the experimenter would be sitting on the blue chair and the subject would be sitting on the black chair). This experimental approach allows researchers to conceptualize cognitive phenomena and influence complex human behavior in populations with deficits in perspective taking, such as those diagnosed on the autistic spectrum. Most of the research in this area has traditionally been the domain of cognitive psychology, under the rubric of ToM (Baron-Cohen, 2001). Although the ToM model was a descriptive account in the first instance, it was subsequently adapted for use as a teaching tool to train ToM skills to children (for an intervention guide that takes into consideration the levels of ToM, see Howlin, Baron-Cohen, & Hadwin, 1999). However, from a contextual behavioral perspective, ToM has been characterized as a description rather than an explanation of the psychological processes involved in perspective-taking (Barnes-Holmes, McHugh, & Barnes-Holmes, 2004b).

A behavioral perspective on the issue of perspective taking was first discussed by Hayes (1984). Several years later, the first RFT experimental study on perspective taking in terms of deictic relational responding was conducted by Barnes-Holmes (2001). In this study, a testing and training protocol was developed for establishing the three deictic relations across the three levels of relational complexity in young children. Since then, further empirical support has been provided on the deictic framing approach. Despite its youth, the *deictic framing approach* has generated a large and growing contribution to the study of domains involving more complex human behavior, such as the self, perspective taking, and empathy (Barnes-Holmes, Barnes-Holmes, Roche, & Smeets, 2001; McHugh, & Stewart, 2012). Barnes-Holmes, Foody, Barnes-Holmes, and McHugh (2013) contributed a book chapter to a text on advances in relational frame theory (see Dymond & Barnes, 2013) that reviewed the research on deictic relations and perspective taking since the first RFT book was published. The current study involves the first bibliographical review of deictic relations. The review includes articles that cited search terms related to deictic relations from the initial publication by Barnes-Holmes in 2001 to 2015. The present bibliographical review, therefore, provides a summary of the progress and limitations in the deictic relations literature with a view to promoting the development of future research in the area.

Method

Database Searches

The search terms *deictic relations*, *perspective taking,* and *relational frames* were individually entered into the ISI Web of Knowledge (Web of Science), PsycARTICLES, ProQuest Psychology Journals, Scopus, Dialnet, and PsycINFO

databases. Searches were conducted for articles that included at least one of these key words.

The quantity of literature on perspective taking necessitated the adoption of strict inclusion and exclusion criteria. We decided to apply the term *relational frame theory* as a mandatory requirement; that is, those articles that did not include a *relational frame theory* approach were excluded. In this way, several studies that included perspective taking from a cognitive point of view or deixis from the semantic and pragmatic approach were not categorized.

An upper date limit of 2015 was employed, and the default lower date limit was 2001. Only journal articles were included in the final data set; that is, dissertation, books, or book chapters were excluded.

Article Type and Classification

Once the articles were identified, they were independently categorized by the present authors. Consistent with the approach adopted by Dixon, Small, and Rosales (2007) and Dymond, May, Munnelly and Hoon (2010), the articles were categorized according to whether they were empirical or not (empirical/nonempirical studies) and the population recruited.

Empirical articles reported original data involving the direct manipulation of at least one independent variable or measurement of at least one dependent variable. To further identify the content addressed by empirical articles, we classified them as either manipulation designs or non-manipulation designs. Manipulation designs systematically manipulated variables to change a participant's behavior. Non-manipulation articles reported original data of at least one dependent variable but did not systematically manipulate variables. Nonempirical articles did not involve manipulation of any independent variables or measurement of any dependent variables and reported no data.

The population was determined based on the demographic information provided in each study. We identified the following categories: (i) the type and (ii) age of the samples. Sample types were classified as either typically developing if the participant did not report a clinical diagnosis or atypically developing if the participant had a clinical diagnosis. Sample ages were classified as early childhood if the participants were below 8 years (young children), as late childhood if the participants were between 8 and 17 years (older children), and adulthood if the participants were 18 years or older. The sample types and age produced six mutually exclusive categories: typically developing adults, atypically developing adults, typically developing young children, atypically developing young children, typically developing older children, and atypically developing older children. If the article included a mixed sample (e.g., adults and children with typical development), then they were included in both categories.

Analyses of Interrater Agreement

Interrater agreement for article assignment to the different categories was calculated by the authors. Specifically, the number of articles assigned to each category was divided by the total number of articles and the result multiplied by 100. In all cases, interrater agreement was higher than 90%. In the case that there was a nonagreement, the authors discussed which category was appropriate and allocated accordingly.

Results

At first, a total of 301 articles were identified with the initial search terms. However, 267 articles were excluded following the search strategy, thus remaining a total of 34 articles in the final data set. Figure 1 shows the increasing trend of published articles from empirical and nonempirical categories between 2001 and 2015. Although the trend of nonempirical articles has remained stable, empirical studies have been increasing. The greatest increase in empirical articles occurred between 2004 and 2007 with the early research of Louise McHugh, Yvonne Barnes-Holmes, and Dermot Barnes-Holmes.

Of the included articles, 26 articles (76.47%) were assigned to the empirical category and eight (23.53%) to the nonempirical category. Of the 26 empirical articles, 14 (53.85%) of studies published between 2001 and 2015 were empirical articles with non-manipulative designs and 14 (53.85%) with manipulative designs. It should be noted that Table 1 shows more empirical articles with non-manipulative designs than with manipulative designs because some articles contributed to more than one population subcategory.

Analysis of the populations studied in the 26 empirical articles, Table 1 shows that the majority of research has been conducted with typically developing populations (92.31%). In particular, 14 (53.85%) involved typically developing children and 10 (38.46%) involved typically developing adults. In terms of the type of design, the more frequent empirical articles were typically developing adults in non-manipulation designs (8/21) and typically developing children in manipulation designs (9/15).

Tables 2 and 3 present a brief summary of each of the empirical and non-empirical articles, respectively. In Table 2, some articles were included in more than one category because they have a mixed sample (e.g., adults, young children, and older children with typical development). In this case, they were divided depending on the population used. For example, if one article had two experiments carried out with typically developing adults and typically developing children, respectively, then each experiment was placed into a different category.

An analysis of the aims of the articles (see Tables 2 and 3) shows that the RFT approach to the conceptualization of mental-state attribution through deictic relations has been

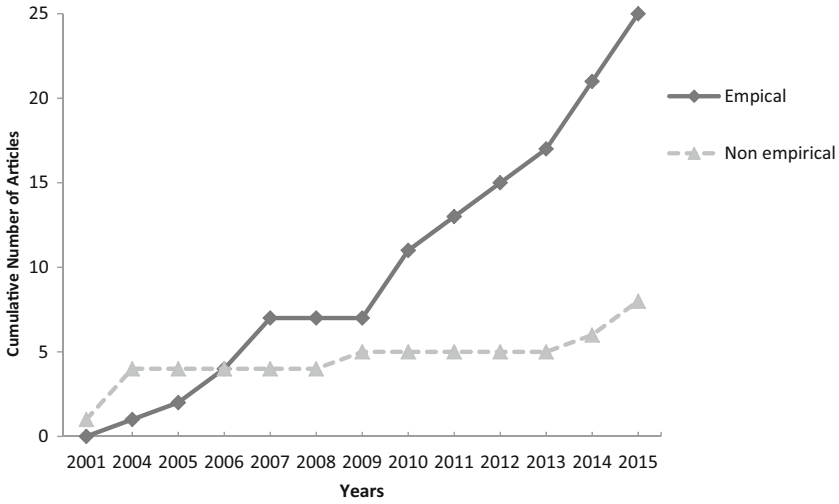

Fig. 1 Cumulative number of empirical and nonempirical articles per year between 2001 and 2015 that reported at least one of the search terms

the main thematic focus. Of the 34 articles included in the final data set, 25 (75.76%) mentioned the term *theory of mind* (ToM) in the text and connected their aims with the mainstream approach (Barnes-Holmes et al., 2001; Barnes-Holmes et al. 2004a; Barnes-Holmes et al. 2004b; DeBernardis et al., 2014; Gilroy et al., 2015; Heagle & Rehfeldt, 2006; Jackson et al., 2014; Janssen et al., 2014; Lovett & Rehfeldt, 2014; McHugh et al., 2004a, 2004b, 2006; McHugh et al. 2007a; McHugh et al. 2007b; Montoya & Molina, 2015; Mori, & Cigala, 2015; O'Neill & Weil, 2014; Rehfeldt et al., 2007; Rendón et al., 2012; Vilardaga et al., 2012; Villatte et al., 2008, 2010a, 2010b; Tibbetts & Rehfeldt, 2005; Weil et al., 2011). The remainder of the studies aimed to examine deictic relations in specific *ACT* techniques (8.82%; Foody et al., 2013; Luciano et al., 2011; Ruiz & Perete, 2015), to examine correlations between deictic framing and other complex cognitive behaviors (8.82%; Gore et al., 2010; Hooper et al., 2015; Vilardaga, 2009), to analyze performance on deictic relations protocol but without relating it to other cognitive variables (5.88%; Meléndez, 2010; Rendón, 2013), or to use deictic relational responding to explore a flexible self (2.94%; McHugh, 2015).

Looking at the journals in which the articles were published, Fig. 2 shows the journal *The Psychological Record* (TPR) has been the one which has published the largest amount of these studies, with 11 empirical articles and one non-empirical article. The second position was by far for *International Journal of Psychology & Psychological Therapy* (IJP&PT), with four empirical articles and one non-empirical article.

Discussion

The current bibliographical review provides growing evidence in support of the application of the RFT-based account of perspective taking to typically and atypically developing children and adults. In line with other studies (Dymond et al., 2010; Ruiz-Sánchez & Montoya-Rodríguez, 2014), the RFT approach to perspective taking has generated a series of intervention programs for establishing derived relational responding in different populations. For example, studies such as Weil et al. (2011) and O'Neill and Weil (2014) have trained deictic framing to establish theory-of-mind skills in populations who were preexperimentally deficient. Others have

Table 1 The number of empirical articles categorized as typical or atypical adults and children and overall percentages

		Manipulative design	Non-manipulative Design	Total
Typically developing adults		2	8	10 (24.42%)
Atypically developing adults		1	4	5 (14.71%)
Typically developing children	Young children	6	2	14 (41.18%)
	Older children	3	3	
Atypically developing children	Young children	1	2	7 (20.59%)
	Older children	2	2	
Total		15 (44.12%)	21 (61.76%)	

Note: Totals do not sum to the total of the empirical articles cited because some articles may have contributed to more than one population subcategory. Percentages in brackets indicate the overall representation of the total of 34 articles

Table 2 Summary of empirical articles distributed by category and population

Category	Population	Study	Sample	Purpose
Empirical articles	Typically developing adults	Foody, Barnes-Holmes, Barnes-Holmes, and Luciano (2013)	44 undergraduate and postgraduate students (18–21 years old)	To compare the relative utility of the two self-based interventions (deictic distinction vs. deictic hierarchical relations) in reducing participants' discomfort, anxiety, and stress after exposure to the distress induction task.
Manipulation designs		Hooper, Erdogan, Keen, Lawton, and McHugh (2015)	80 participants who were randomly assigned to four groups	To contrast if a perspective taking training versus no training could reduce the fundamental attribution error, measured via a typical attitude attribution task.
	Atypically developing adults	O'Neill and Weil (2014)	3 adults with a diagnosis of schizophrenia and mild-moderate intellectual disability (47—66 years)	To train deictic relational responding to improve the scores on theory of mind (ToM) tasks (deceptive container and hinting tasks).
	Typically developing older children	Heagle and Rehfeldt (2006)	3 typically developing children with no known disabilities (6–11 years)	To improve the performance on the deictic relational protocol by means of reinforcement contingencies during the training trials for correct responses.
		Luciano, Ruiz, Vizcaino, Sánchez, Gutiérrez, and López (2011)	15 adolescent students (12–15 years old) with high scores in the impulsivity or in the emotional subscales of the *Behavior Assessment System for Children* (BASC)	To evaluate the impact of two defusion protocols (deictic framing vs. deictic plus hierarchical framing examples with examples for promoting the function of regulating one's own behavior) that were designed on the basis of some typical interactions in acceptance and commitment therapy.
		Rehfeldt, Dillen, Ziomek, and Kowalchuk (2007)	*Study II* Two typically developing children (9–10 years)	*Study II* To improve the performance on the Barnes-Holmes protocol due to specific reinforcement for responding relationally.
	Atypically developing older children	Gilroy, Lorah, Dodgea, and Fiorello (2015)	3 children (8–11 years) with autism	To establish deictic framing using newer, more naturalistic deictic framing training protocol in children diagnosed with an autism spectrum disorder.
		Lovett and Rehfeldt (2014)	3 young adults diagnosed with Asperger syndrome (17–18 years)	To evaluate the use of multiple exemplar instruction (MEI) to teach perspective-taking skills to adolescents with Asperger syndrome and to examine generalization of perspective-taking skills following instruction.
Empirical articles		Heagle and Rehfeldt (2006)	3 typically developing children with no known disabilities (6–11 years)	To improve the performance on the deictic relational protocol by means of reinforcement contingencies during the training trials for correct responses.
Manipulation designs		Meléndez (2010)	A typically developing child (3 years)	A multiple exemplar training to develop the deictic relational responding.
		McHugh et al. (2004b)	*Study II* 16 children (3–5 years and 6–8 years)	*Study II* To assess the deictic relational protocol similar to Study 1, but all of the reversed and double reversed trials were modified with foils to control the possible effect of word length.
	Typically developing young children	Rendón, Soler, and Cortés (2012)	4 typically developing children (3–4 years)	To evaluate the impact of multiple reinforcement exemplars for relational responding according to contextual cues in establishing simple deictic relations and the impact of this training on ToM and social competence scores.
		Ruiz and Perete (2015)	A 5-year-old boy	To promote psychological flexibility by providing a multiple-exemplar training to relationally frame his ongoing experiences through deictic and hierarchical relations and to transform their discriminative functions by means of relating them to rules that progressively specified longer term and symbolic, positive consequences for not acting fused with the private experiences.
		Weil, Hayes, and Capurro (2011)	3 typically developing children (4–5 years)	

Table 2 (continued)

Category	Population	Study	Sample	Purpose
				To evaluate the potential emergence of perspective taking (measured with a traditional ToM tasks) due to acquisition of the deictic relations.
Empirical articles	Atypically developing young children	Jackson, Mendoza, and Adams (2014)	Five children diagnosed with autism (5–6 years)	To examine the effects of increased deictic relational responding on ToM scores with children with autism.
Non-manipulation designs		McHugh et al. (2004b)	*Study I*: 40 participants, 8 from each of 5 age ranges as follows: 3–5 years, 6–8 years, 9–11 years, 12–15 years, and 18–30 years *Study III*: 8 adults (18–30 years)	*Study I* To assess the deictic relational protocol. *Study III* To assess the deictic relational protocol used in Study 1, via an automated protocol (i.e., computerized).
Empirical articles	Typically developing adults	McHugh, Barnes-Holmes, Barnes-Holmes, and Stewart (2006)	40 participants, 8 from each of 5 age ranges as follows: 3–5 years, 6–8 years, 9–11 years, 12–15 years, and 18–30 years	To show differences in the deictic framing from various age groups on protocols involving true and false belief tasks in which deictic relational frames as well as logical *not* were emphasized explicitly.
Non-manipulation designs		McHugh, Barnes-Holmes, Barnes-Holmes, Stewart, and Dymond (2007a)	40 participants, 8 from each of 5 age ranges as follows: 3–5 years, 6–8 years, 9–11 years, 12–15 years, and 18–30 years	To investigate deception in the context of tasks involving two levels of relational complexity: (1) deictic relational complexity (i.e., first- and second-order) and (2) nondeictic relational complexity (i.e., presence or absence of logical *not*).
		McHugh, Barnes-Holmes, Barnes-Holmes, Whelan, and Stewart (2007b)	20 university undergraduates (21–32 years)	Assessment of perspective taking skills along three primary dimensions: (1) perspective taking (self, other, and photograph); (2) belief (true belief or false belief); and (3) statement type (whether the response was true or false).
		Montoya and Molina (2015)	40 university undergraduates (21–43 years)	To analyze the relationship between deictic frames and a ToM task.
		Vilardaga, Estévez, Levin, and Hayes (2012)	110 university undergraduates	To relate the scores in social anhedonia, empathic, and experiential avoidance with deictic relational responding measured on a behavioral task based on a previous protocol developed by Y. Barnes-Holmes (2001).
		Villatte, Monestès, McHugh, Freixa i Baqué, and Loas (2008)	Experimental group: 30 adults with high social anhedonia Control group: 30 adults typically developing	To examine whether ToM impairments (using a task modeled on the hinting task) are linked to social anhedonia and whether such impairments could be accounted for in terms of deficits in deictic relational responding.
		Villatte, Monestès, McHugh, Freixa i Baqué, and Loas (2010a)	*Study I* *Experimental group:* 30 nonclinical participants with a high level of social anhedonia (18–21 years) *Control group:* 30 nonclinical participants without a high level of social anhedonia (18–22 years)	*Study I* To assess deictic relational responding involved in belief attribution, according to two types of attribution (self and other) crossed with two types of belief (true and false).
	Atypically developing adults	Gore, Barnes-Holmes, and Murphy (2010)	24 adults with mild to moderate intellectual disabilities	To analyze the potential relationship among performances on the RFT perspective-taking protocol and a number of standard measures of intellectual and language abilities (BPVS-II and WASI).
		Janssen et al. (2014)	Experimental group: 13 adults diagnosed with social anxiety disorder (SAD) (22–54 years) Control group: 14 healthy adults (21–59 years)	To examine deictic relational responding skills in a sample of adults suffering from SAD and compared their performances with an age-matched sample of healthy peers.
		Villatte et al. (2010a)	*Study II* Experimental group: 15 patients diagnosed with schizophrenia (22–53 years)	*Study II* To replicate the Study I to compare the performance between clinical and nonclinical population.

Table 2 (continued)

Category	Population	Study	Sample	Purpose
			Control group: 15 healthy participants (20–63 years)	
		Villatte, Monestès, McHugh, Freixa i Baqué, and Loas (2010b)	15 patients diagnosed with schizophrenia (22–53 years) and 15 age-matched controls (20–63 years)	To compare the performance on deictic relational responding and on a task consisting of attributing the intentions of others (using a task modeled on the hinting task) in participants with schizophrenia versus with typically developing participant.
Empirical articles Non-manipulation designs	Typically developing older children	McHugh et al. (2004b)	*Study 1* 40 participants, 8 from each of 5 age ranges as follows: 3–5 years, 6–8 years, 9–11 years, 12–15 years, and 18–30 years	*Study 1* To assess the deictic relational protocol.
		McHugh et al. (2007a)	40 participants, 8 from each of 5 age ranges as follows: 3–5 years, 6–8 years, 9–11 years, 12–15 years, and 18–30 years	To investigate deception in the context of tasks involving two levels of relational complexity: (1) deictic relational complexity (i.e., first- and second-order) and (2) nondeictic relational complexity (i.e., presence or absence of logical *not*).
		Rendón (2013)	63 participants divided into 2 groups (9–12 years)	To explore differences in the performance of deictic tasks presented in a face-to-face interview format, in contrast with a an automated computerized version.
	Atypically developing older children	Rehfeldt et al. (2007)	*Study 1* Experimental Group: 9 children with high-functioning autism or Asperger syndrome (6–13 years) Control Group: 9 typically developing children (6–13 years).	To determine if children with autism spectrum disorder would perform significantly worse on the Barnes-Holmes protocol than their age-matched typically developing peers.
		Tibbetts and Rehfeldt (2005)	4 children with high-functioning autism (7-–10 years).	To use an automated computerized version of the Barnes-Holmes protocol to evaluate relational learning deficits in perspective taking in children with high-functioning autism.
	Typically developing young children	McHugh et al. (2004b)	*Study 1* 40 participants, 8 from each of 5 age ranges as follows: 3–5 years, 6–8 years, 9–11 years, 12–15 years, and 18–30 years	*Study 1* To assess the deictic relational protocol.
		McHugh et al. (2007b)	40 participants, 8 from each of 5 age ranges as follows: 3–5 years, 6–8 years, 9–11 years, 12–15 years, and 18–30 years	To investigate deception in the context of tasks involving two levels of relational complexity: (1) deictic relational complexity (i.e., first- and second-order) and (2) nondeictic relational complexity (i.e., presence or absence of logical *not*).
	Atypically developing young children	Rehfeldt et al. (2007)	*Study 1* Experimental group: 9 children with high-functioning autism or Asperger syndrome (6–13 years) Control group: 9 typically developing children (6–13 years)	To determine if children with autism spectrum disorder would perform significantly worse on the Barnes-Holmes protocol than their age-matched typically developing peers.
		Tibbetts and Rehfeldt (2005)	Four children with high-functioning autism (7-–10 years).	To use an automated computerized version of the Barnes-Holmes protocol to evaluate relational learning deficits in perspective-taking in children with high-functioning autism.

Table 3 Summary of nonempirical articles

CATEGORY	STUDY	PURPOSE
Nonempirical articles	Barnes-Holmes et al.(2001)	To analyze both the traditional and the modern behavioral approach to self to end advocating the relational frame theory (RFT) approach to perspective taking through deictic relations.
	Barnes-Holmes, Barnes-Holmes, and McHugh (2004a)	To summarize the implications from the interventions driven by RFT for educational practice, including the RFT approach to perspective taking.
	Barnes-Holmes, McHugh, and Barnes-Holmes (2004b)	To present the basic concepts of RFT, to analyze RFT approach to cognitive perspective taking, and to revise the empirical evidence that supports this view.
	DeBernardis, Hayes, and Fryling (2014)	To propose a continuum of perspective taking behavior, ranging from relatively simple to complex types of behavior. To articulate the value of an interbehavioral approach versus theory of mind (ToM) and RFT approaches.
	McHugh et al. (2004a)	To revise the mainstream research into perspective taking, false belief understanding and deception, to describe the RFT approach to these skills and to present several recent studies that have investigated this approach.
	McHugh (2015)	To examine a theoretical account of three functionally distinct steps (Step 1 involves deictic relational frames, Step 2 involves empathy training via the transformation of emotional functions, and Step 3 involves deictic "self-as-context" training regarding one's own private events) to the development of a flexible perspective taking also referred to as flexible connectedness from the contextual behavior science point of view.
	Mori and Cigala (2015)	To analyze the scientific psychological literature from 1995 to the present on the main methods of intervention (the cognitive approach–ToM, the behaviorist approach–RFT, and the socioconstructionist approach) used to promote perspective taking in developmentally typical preschool children.
	Vilardaga (2009)	To revise the empathy literature and to analyze the RFT conceptualization of perspective taking and empathy through the deictic framing.

shown that deictic responding can help to understand clinical issues such as social anhedonia or schizophrenia (e.g., Janssen et al., 2014; Villatte et al. 2008, 2010a, b). A deictic relational frame account has also been used to explore ACT at a more basic level (Foody et al., 2013; Luciano et al., 2011; Ruiz, & Perete, 2015). The findings from these empirical articles indicated the importance of particular patterns of relational responding (including deictic relational responding) for core act processes and provide a basis for future applied research investigating deictic relational responding and ACT.

However, to date most of research has focused on populations with typical development (92.31%). The least amount of empirical work has been conducted with atypically developing adults and young children. The articles reviewed for the current study support the postulate that a deictic frames protocol can be a developmental and educational tool. However,

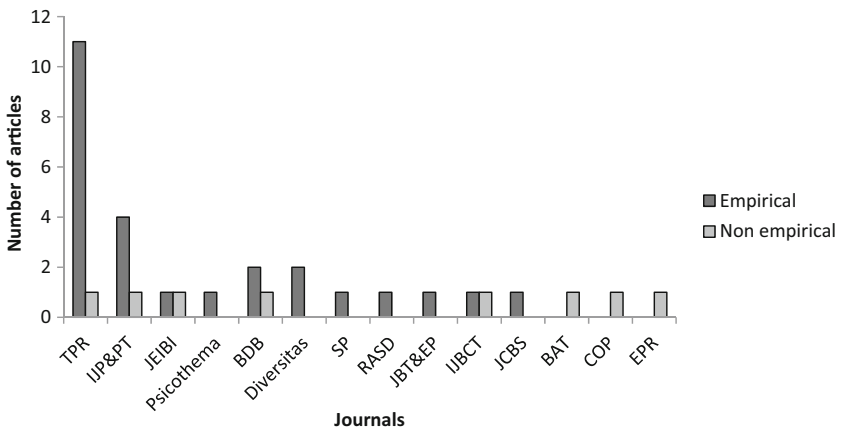

Fig. 2 Summary of the journals deictic relations articles were published in. TPR = *The Psychological Record*; IJP&PT = *International Journal of Psychology & Psychological Therapy*; JEIBI = *Journal of Early and Intensive Behavior Intervention*; BDB = *Behavioral Development Bulletin*; SP = *Suma Psicológica*; RASD = *Research in Autism Spectrum Disorders*; JBT&EP = *Journal of Behavior Therapy and Experimental Psychiatry*; IJBCT = *International Journal of Behavioral Consultations and Therapy*; JCBS = *Journal of Contextual Behavioral Science*; BAT = *Behavior Analyst Today*; COP = *Current Opinion in Psychology*; EPR = *Educational Psychology Review*

there are very few empirical attempts to establish deictic relations in populations who are deficient in these repertoires. The present review shows an equal number of non-manipulative rather than manipulative designs. While non-manipulative designs are informative, they do not allow the prediction and influence of behavior through *the manipulation of* environmental *variables* (Skinner, 1953). *Although* RFT research has indicated that deictic framing runs parallel to the developmental levels of perspective taking as assessed in the cognitive approach referred to as theory of mind (see, e.g., Barnes-Holmes, Gilroy, et al., 2015; Janssen et al., 2014; McHugh et al., 2004a, 2004b; Rehfeldt et al., 2007; Villatte et al., 2008), very few studies have evaluated the impact of deictic relational training on traditional ToM tasks. Specifically, only five studies of the 26 empirical articles have provided empirical evidence examining the relationship between these variables (Jackson et al., 2014; Lovett & Rehfeldt, 2014; O'Neill & Weil, 2014; Rendón et al., 2012; Weil et al., 2011). Of these, only three articles were conducted with participants with a known diagnosis (i.e., 3/26 empirical articles were conducted with atypically developing populations). While the results from these three studies were promising, much more work is needed. Future research should expand on these early investigations of deictic relation training in populations characterized by perspective taking deficits.

In addition to this, the training protocols derived so far for training deictic relational responding need further investigation and development. The number of outcome variables in the training studies thus far has been limited. Future work should test whether improvements in deictic relational responding (such as those demonstrated by O'Neill & Weil, 2014) impact on variables such as diagnosis, decreased disruptions in functioning, or enhancing quality of life. In addition to this some empirical demonstrations of basic theoretical assumptions need to be conducted. For example, the RFT literature suggests that empathy is the transformation of emotional functions across deictic relations (see Stewart & McHugh, 2013; Vilardaga, 2009). However, there is no published work extending the research on perspective taking to empathy by testing the effectiveness of training the transformation of emotional functions across deictic relations.

A number of sources have suggested that RFT can inform the development of acceptance and commitment therapy (ACT). The current review points to three studies that have linked the RFT deictic relations literature and the development of more effective ACT techniques (Foody et al., 2013; Luciano et al., 2011; Ruiz & Perete, 2015). This type of research is in its infancy. Future research needs to expand the literature on clinical RFT and to determine how RFT deictic relations work can inform and development ACT and psychotherapeutic interventions more generally (see Villatte, Villatte, & Hayes, 2016).

Finally, in reviewing the journals in which the work is published, the two most widely used outlets are TPR and IJP&PT. Both of these journals publish empirical and theoretical works from a behavior analysis approach; however, their relative impact is low. Specifically, IJP&PT does not have an impact factor and TPR has low impact (0.879 in the year 2014). Nonetheless, the last studies have been published in higher impact journals. For example, Gilroy et al. (2015) was published in *Research in Autism Spectrum Disorders* (RASD) with a 2.12 impact factor, and Mori and Cigala (2015) was published in *Educational Psychology Review* (EPR) with a 2.56 impact. Furthermore, RASD consists of an interdisciplinary genetic, neurobiological, cognitive, and behavioral approach. This demonstrates that across time the deictic relations work is extending its scope of publication with publications in higher impact outlets.

In conclusion, the present study indicates that RFT research into deictic relations has made an important contribution to the literature in the last two decades. For example, establishing deictic relations in those diagnosed with autistic spectrum conditions or analyzing the deficits in perspective taking from a behavioral point of view in clinical populations such as schizophrenia. However, there are still important future directions to an empirically supported comprehensive understanding of the development of deictic relations in typical and atypical development, as well how a bottom-up understanding of deictic relations can promote the design of effective tools to use in contemporary therapies such as ACT. Reviews such as this one are imperative for the consolidation of the dissemination of ideas and practices to the larger community of researchers and practitioners to help advance our understanding of how to remediate deficits in core skill sets.

Compliance with Ethical Standards

Conflict of Interest The first author was supported by a predoctoral fellowship from the Ministry of Education's University Faculty Training (FPU) program (FPU, Grant # AP2010-5957). The other authors declare no potential conflict of interest.

Ethical Approval This article does not contain any studies with human participants or animals performed by any of the authors.

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