

## **A Review of Empirical Relational Frame Theory Articles in Children and Adolescents with Developmental Disabilities**

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The research initiated by the new behavioural-functional approach to the study of language and human cognition that contributes to Relational frame theory (RFT), has provided a large body of knowledge into areas traditionally dominated by cognitive psychology. In addition to a theoretical understanding of complex behaviour, this new tool enables the design of effective practice strategies for individuals deficient in these repertoires. This study analyzes the contributions made to date by the RFT in children and adolescents with developmental disabilities. A total of 58 articles were selected following the criteria established between 1986 and 2014, 23 of which included atypically developing participants and 35 typically developing. The results indicate an increasing amount of empirical evidence both in populations with typical and atypical development. However, most empirical research on RFT has been conducted with typically developing population. Possible future research necessary for a more complete study within the area of developmental disabilities, such as the relational frame of temporal, causality or hierarchical frame, is considered.

*Keywords:* Relational Frame Theory, developmental disability, childhood.

*Una Revisión de Artículos Empíricos desde la Teoría de los Marcos Relacionales en Niños y Adolescentes con Retraso en el Desarrollo.* La investigación promovida desde la nueva aproximación conductual-funcional al estudio del lenguaje y cognición humanas que aporta la *Teoría de los marcos relacionales* (TMR) ha dotado de un amplio cuerpo de conocimiento a áreas tradicionalmente dominadas por la psicología cognitiva. Además de una comprensión teórica del comportamiento complejo, esta nueva herramienta posibilita el diseño de estrategias prácticas eficaces dirigidas a poblaciones con repertorios deficitarios. El presente estudio analiza las aportaciones realizadas hasta la fecha por la TMR en la población infantil y adolescente con retraso en el desarrollo. Un total de 58 artículos fueron seleccionados siguiendo los criterios establecidos entre los años 1986 y 2014, 23 de los cuales incluían población con un desarrollo normalizado and 35 con retraso en el desarrollo. Los resultados indican un creciente aumento de la evidencia empírica tanto en población con desarrollo típico como atípico. Sin embargo, la mayoría de las investigaciones empíricas sobre TMR han sido llevadas a cabo con población de desarrollo normalizado. Se discuten las posibles líneas futuras de investigación necesarias para un abordaje más completo al área de retraso en el desarrollo, tales como relaciones en el marco de temporalidad, causalidad o jerarquía.

*Palabras clave:* Teoría de los Marcos Relacionales, retraso, infancia.

Learning to relate words-objects-actions-functions very early and through numerous examples is an inherently human behaviour acquired on the basis of a history of reinforcement provided by the verbal community (Wilson & Luciano, 2002). For example, when in the normal development of the child, they are given a new toy (e.g., a musical instrument) and told its name ("trumpet"), and then asked to identify the trumpet from a number of instruments responding to the question "Which is the trumpet?", the child could point it out without explicit training. In this example, the child is responding on the basis of a contextual cue ("is"), to a stimulus (the question "Which is the trumpet?") in terms of another (trumpet) with which does not share common physical elements. According to Relational Frame Theory (RFT; Hayes, Barnes-Holmes & Roche, 2001), the individual would be relationally responding to stimuli. This way of relating stimuli is established by differential reinforcement of response types across numerous examples in the presence of contextual cues functionally abstracted ("is like", "different to", "bigger than", etc.), starting with the non-arbitrary stimulus sets, i.e. those who share physical properties, and then transferring the relational properties under arbitrary contextual control (Hayes *et al.*, 2001; Hayes & Quñones, 2005).

RFT is a recent functional- analytic approach to the study of language and cognition that represents a progress in the analysis and understanding of complex behavioural phenomena that have traditionally been approached through aspects of cognitive psychology, such as empathy, self-concept, intelligence or creative behaviour (McHugh, Barnes-Holmes & Barnes-Holmes, 2004; O'Toole, Barnes-Holmes, Murphy, O'Connor & Barnes-Holmes, 2009).

Currently, RFT recognizes that there are several ways in which the stimuli are related, which means that there are different kinds of specific relational frames: coordination (which implies identity, sameness, or similarity, i.e. A is equal to B ), opposition (A is the opposite of B), distinction (which involves responding to one event in terms of its differences with another event, but without the context of opposition), comparison (e.g. A is worse / bigger than B) , hierarchy (e.g. A is an attribute of member 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").

*Relational frame* makes reference to the response is controlled by a contextual control and is arbitrarily applied, that is, given a history of reinforcement with multiple examples the pattern of response among a group of topographically different stimuli is abstracted and placed under the arbitrary contextual controlled cues (sameness, opposition, comparison, etc.). According to RFT a relational frame must satisfy three properties: mutual entailment, combinatorial entailment, and transformation of functions. *Mutual entailment* or derived bi-directionality refers to respond to a stimulus in terms of

the other and vice versa. For example, if A is the same as B, then B is the same as A. However, if A is greater than B, B is less than A. *Combinatorial entailment* refers to the derived relation which emerges through the combination of various relations (e.g. if in a specific context A is less than B and B is less than C, then A is less than C and C is more than A). *Transformation of stimulus functions* occurs when the psychological functions of a stimulus in a specific relation are transformed based on the nature of the relationship to which the stimulus belongs (e.g. If in a frame of opposition between A and B, A acquires aversive functions, B does not acquire such functions).

Since the first book on RFT was published in 2001 (Hayes *et al.*, 2001), a growing body of knowledge has shown the empirical and conceptual relationship between relational responding and language and cognitive skills (e.g., Gore, Barnes Holmes & Murphy, 2010; O'Hora, Paláez & Barnes-Holmes, 2005). When doing a search on the website of the Association for Contextual Behavioral Science (ACBS), using the filter "RFT: Empirical", more than 230 articles since 1986 were found based on scientific evidence of RFT data. The ACBS is an organization founded in 2005 to promote the advancement of behavioural contextual science and contributions made by RFT.

Numerous avenues of research resulting from this approach have led experts to design effective procedures which have established or facilitated new derived relational responding in children (e.g., Barnes-Holmes, Barnes-Holmes & Smeets, 2004; Barnes-Holmes, Barnes-Holmes, Smeets, Strand & Friman, 2004; Smeets, Barnes & Roche, 1997). This becomes very useful in children and adolescents with developmental delay, since the application of the work from the RFT allows for the development of practical strategies that make possible the acquisition of skills in those deficient repertoires. Such is the case of the proposal made by Rehfeldt and Barnes-Holmes (2009) who developed a number of procedures from derived relational responding applications, for students with autism and other developmental disabilities, in order to help them acquire both basic and complex cognitive skills.

However, to date there has been no citation analysis of RFT empirical studies in children and adolescents with developmental delays to clarify the state of research in this area. In this study, therefore, citation analysis is performed by looking at the literature databases of articles that apply the basic principles of RFT in these populations in order to conclude the progress and deficiencies with a view to establishing future research.

## METHOD

### *Procedure*

The search terms relational frame theory, relational frames and arbitrarily applicable relations were individually entered into the PsycINFO databases and the ISI Web of Knowledge (Web of Science; WOS). Searches were conducted for articles that included at least one of these key words. In WOS, the search was refined to articles of psychology, behavioural sciences or educational research. In PsycINFO the search was refined to articles and ages groups between infancy and adolescence.

A manual search of these relevant references was also performed. The search was conducted on articles published between 1981 and 2014. The articles were selected if they a) included individuals with developmental disabilities or atypical development (e.g. any type of label or descriptor that indicated below-average level of functioning); b) included at least one participant under the age of 18 and c) reported original data involving derived relational responding and direct manipulation of at least one independent variable and measurement of at least one dependent variable (empirical articles).

### *Type of article and classification*

Once the articles were identified, they were independently categorized by two researchers. Inter-observer agreement, calculated by dividing the number of articles assigned to the same category by the total number of articles and multiplying the result by 100, was 92%. If the article included a mix sample (e.g. children or adolescents with typical and atypical development) they were categorized in both categories. Only articles that included individuals with developmental disabilities were included for a further analysis.

## RESULTS

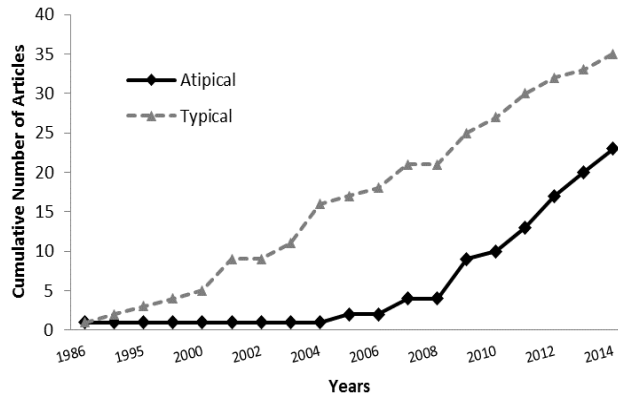
Following the search strategy, 441 articles were identified. Of these, 58 satisfied the criteria, 23 of which involved atypically developing population and 35 involved typically developing. Figure 1 show the cumulative number of articles which included typical and atypical population between 1986 and 2014.

The table 1 presents a brief summary from each of the 23 articles in which the sample included in a typically developing population. The highest number of publications derived from topics such as coordination frames, derived mands and derived intraverbal responding.

Table 1. Articles in which the sample included atypically developing population published between 1986 and 2014

CATEGORY	REFERENCE	RESEARCH AREA	SAMPLE	PURPOSE	
Basic Relational Framing Repertoires	Devany, Hayes, Rosemary (1986)	Coordination	N=12 (14 to 36 months) Diagnostic: four children were normal and eight presented a developmental delay	Analysis of differences between normal and language deficient children in performance on test of equivalence.	
	Murphy, Barnes-Holmes and Barnes-Holmes (2005)	Derived Mandts	N=7 (5 to 9 years old) Diagnostic: six children with ASD and one with ASD and hyperactivity disorder (ADHD)	Multiple exemplars training to establish derived mand functions (asking for more of two types of tokens using two mand responses that had not been directly trained).	
	Akós and Lora (2007)	Coordination and distinction	N=1 (7 years old) Diagnostic: intellectual disability	Training discrimination of "same" and "different" in two numbers (one and two) and testing transference with two new numbers (three and four)	
	Perez, García, Williams y Camerero (2007)	Derived Intraverbals	N=2 (6 and 8 years old) Diagnostic: pervasive developmental disorder	Multiple exemplars training to establish derived intraverbal autonyms (e.g. cold in response to name the opposite of hot)	
	Miguel, Yang, Finn and Ahearn (2009)	Coordination	N=2 (6 years old) Diagnostic: Autism Spectrum Disorder (ASD)	Training to match dictated words (A) to pictures (B) and dictated words (A) to printed words (C). After training, children respond to C-B, B-C relations and read printed word aloud without direct training.	
	Gorham, Barnes-Holmes, Barnes-Holmes and Berens (2009)	Comparison	N=8 (6 to 11 years old) Diagnostic: five of them presented ASD	Multiple exemplars training to establish repertoires of responding in accordance with more than and less than involving four coins stimuli.	
	Murphy and Barnes-Holmes (2009a)	Derived Mandts	N=3 (4-10years old) Diagnostic: one of them presented severe speech delay	Training five specific mand functions for stimuli to determine whether derived mand functions emerged for the other stimuli.	
	Murphy and Barnes-Holmes (2009b)	Derived Mandts	N=3 (7 to 14 years old) Diagnostic: high functioning ASD	Match to sample training to establish two different classes of derived mand, one class as request for more and the other as request for less.	
	O'Connor, Rafferty, Barnes-Holmes and Barnes-Holmes (2009)	Coordination	N=18 (5 to 10 years old) Diagnostic: fifteen presented ASD and three were typically developed.	Analysis of relationship among naming, verbal competence, and equivalence by comparing the equivalence performance of children with different levels of verbal ability.	
	Murphy and Barnes-Holmes (2010)	Derived Mandts	N=3 (14 years old) Diagnostic: ASD	MET to establish five derived mand for the delivery or removal of token by presenting nonsense syllables.	
	Cassidy, Roche and Hayes (2011)	Coordination, comparison and opposition	Study 2, N=8 (11-12 years old) Diagnostic: ADHD and learning difficulties	Multiple exemplar training for SAME, MORE THAN, LESS THAN, and OPPOSITE relational frames to improve IQ measure taken using the WISC-IVUK.	
	Tarbox, Zuckerman, Bishop, Olive and O'Hora (2011)	Conditional relations	Study 1, N=3 (3-5 years old) Diagnostic: ASD Study 2, N=3 (5-7 years old) Diagnostic: ASD	Two experiments evaluate multiple exemplar training procedures for establishing the generalized ability to respond to novel rules, containing if then contingency statements that describe antecedents and behaviors.	
	Grunnan and Rehfeldt (2012)	Derived Intraverbals	N=2 (5 years old) Diagnostic: ASD	Evaluate the effect of tact and match to sample instruction on categorization intraverbals.	
	Speckman, Greer and Rivera-Vallés (2012)	Derived Autoclitics	Study 1, N=3 (4-5years old) Diagnostic: two of them presented language delay Study 2, N=3 (3-4years old) Diagnostic: one of them presented language delay	Multiple exemplar instruction to evaluate the emergence of productive suffixes as autoclitic frames.	
	May, Hawkins and Dymond (2013)	Derived Intraverbals	N=3 (11 to 15 years old) Diagnostic: ASD	Effects of tact training involving three stimuli (A-B and A-C) on the emergence of untaught intraverbal (B-C and C-B) vocal response	
	Dunne, Foody, Barnes-Holmes, Barnes-Holmes and Murphy (2014)	Coordination, opposition, distinction and comparison	N=9 (3 to 5 years) Diagnostic: ASD	Establishment of an extended sequence of training and testing in consecutive relational frames: first, coordination; second, opposition; third, distinction; and fourth, comparison relations.	
	Complex Repertoires	Walsh, Horgan, May, Dymond and Whelan (2014)	Coordination	Study 1, N=9 (5 to 18 years old) Diagnostic: ASD Study 2, N=8 (5 to 11 years old) Diagnostic: five of them presented ASD	Establishing derived relation with Relational completion procedure (RCP) in combination with multiple exemplars training (when required).
		Gould, Tarbox, O'Hora, Noone and Bergstrom (2011)	Perspective-taking	N=3 (3-5 years old) Diagnostic: ASD	Multiple exemplars training to teach children to identify what another person can see, by following their facial orientation and eye-gaze. Generalization to untrained stimuli and to the natural environment are also assessed
Baltuschat, Hasselhorn, Tarbox, Dixon, Najdowski, Mullins and Gould (2012)		Working memory	N=3 (6-9 years old) Diagnostic: ASD	Assessment of maintenance and generalized improvement in a working memory task (DBS, digit span backwards task) after a basic behavioral procedure of positive reinforcement of multiple exemplars	
Persicke, Tarbox, Ranick and St Clair (2012)		Metaphorical reasoning	N=3 (5-7 years old) Diagnostic: ASD	Multiple exemplar training (with differential prompts such as questions to help the child talk through the hierarchical relations, relations of distinction and relations of coordination between the target and vehicle, or visual aids) for teaching children to attend to relevant features of the context in which a metaphor is used and to engage in the required relational responding in order to respond correctly to metaphorical questions	
Persicke, Tarbox, Ranick and St Clair (2013)		Understanding sarcasm	N=3 (6-7 years old) Diagnostic: ASD	Teaching via multiple exemplar training (including rules, video clips, and in vivo training) to accurately detect and appropriately respond to sarcastic comments in the course of normal everyday conversation.	
Ranick, Persicke, Tarbox and Kornack (2013)		Understanding deception	N=3 (6-9 years old) Diagnostic: ASD	Multiple exemplar training to teach (including rules, modeling, role-play, and immediate feedback) the generalized skill of identifying deceptive comments and responding appropriately to those statements	
Lovett and Rehfeldt (2014)		Perspective taking	N=3 (17-18 years old) Diagnostic: Asperger syndrome	Assessment and training of the perspective taking via deictic frames of I-You, Here-There, and Now-Then (including the three levels of relational complexity). Generalization of perspective taking skills is evaluated using two standardized assessments designed to evaluate theory of mind (such as Social Language Development Test Adolescent and Theory of Mind Inventory) which are administered at pre and posttest.	

Figure 1. The cumulative number of articles with atypically and typically developing samples per year between 1986 and 2014 that reported at least one of the search terms



## DISCUSSION

The empirical literature reviewed in the present research provides a growing evidence about the application of RFT to typically and atypically developing children and adolescents. In line with other studies (Dymond, May, Munnely & Hoon, 2010), numerous contributions made from this approach have generated a series of intervention programs for establishing derived relational responding in different populations. For example, this approach has studied the conditions under which derived coordinate relations emerge in childhood with typically developing children (Luciano, Gómez & Rodríguez, 2007). It has also been observed how different repertoires of relational responding, such as the frame of opposition (Barnes-Holmes, Barnes-Holmes & Smeets, 2004) and the frame of comparison, can be established in children 4 to 6 years (Berens & Hayes, 2007) or how training on the previous frames increases intelligence (Cassidy, Roche & Hayes, 2011). Other studies have addressed complex issues such as perspective taking skills in children (e.g., Weil, Hayes & Capurro, 2011) or the involvement of deictic and hierarchical relationships in the regulation of behavior (Luciano *et al.*, 2011) among others.

To date most studies applied to children and adolescents have focused on populations with typical development, in line with other revisions made up to 2008 (Dymond *et al.*, 2010). Among the works applied to the population with atypical development are the relations of coordination (e.g., Miguel *et al.*, 2009) and transfer of mand functions through these relationships (Murphy *et al.*, 2005). These studies expand the applied relevance of RFT to the functional establishment of repertoire of

communication with individuals with developmental problems. Similarly, there has been evaluated the impact of multiple exemplar training to establish derived intraverbal responses (Grannan & Rehfeldt, 2012; Pérez *et al.*, 2007). Such repertoires are of great importance in academic contexts and provide an alternative to direct training which does not provide a flexible and generalized behaviour. Other training has focused on skills that require the above, such as conditional relations (Tarbox *et al.*, 2011), perspective taking (e.g., Gould *et al.*, 2011), sequential relations (working memory) (Baltruschat *et al.*, 2012) or metaphorical reasoning (Persicke *et al.*, 2012) among others.

It is now more than 5 years since the publication of the first book for teaching derived relational responding in students with developmental disabilities (Rehfeldt and Barnes-Holmes, 2009) and seems to increasingly be seen that the RFT can provide effective training in developmental delayed population including autism spectrum disorders (ASD). However, the literature is still lacking in the training of temporal relations, causality or hierarchy in this population. Similarly, it has not yet accumulated enough evidence on conditional or sequential relations among other skills. This is not only applicable to people with developmental delay, but it is also necessary to accumulate more empirical evidence from participants with normal development.

The present study provides a review of current state of applied work from RFT in children and adolescents with developmental disabilities, however it must be considered in light of certain limitations. Only two databases have been reviewed, which may have generated data loss. Similarly, articles that include mixed population were included in both categories (typical and atypical development) and can inflate the number of results. However, apart from the above limitations, the results are in line with other authors (Dymond *et al.*, 2010), allowing for the provision of relevant information about the current state of research in this area.

In conclusion, although our findings indicate that RFT has made an important contribution to the literature in a short period of time, there are still future directions to explore to help design effective tools to aid in the acquisition of complex skills in language and cognition in this population.

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