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COMMENTARY

Bridging the Gaps in the Study of Typical and Atypical Cognitive Development: A Commentary

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The articles in this special issue of the *Journal of Cognition and Development* examine the cognitive development of children who are following typical and atypical developmental pathways. The articles offer a mixture of theory-based considerations, reviews of the literature, and new empirical data addressing fundamental aspects of cognitive development. Our commentary considers these articles in light of comparative and dimensional approaches to the study of typicality/atypicality and offers some considerations for researchers building bridges between typical and atypical development.

The goal of this special issue of the *Journal of Cognition and Development* is to build bridges between developmental scientists who study aspects of typical development and those who study atypical development. The special issue articles offer a mixture of theory-based considerations, reviews of the literature, and new empirical data. Independently, the studies in this special issue highlight the importance of studying the full spectrum of development, from typical to atypical. Collectively, these articles increase our understanding of cognitive development with the ultimate goal of creating increasingly stronger bridges among developmentalists seeking to elucidate the unfolding of cognition in children.

The assumption that understanding typical development will inform our understanding of atypical development, and vice versa, is certainly not controversial. The challenge, however, is to foster collaborative research that bridges typical and atypical development. We believe that increasing the interaction between scientists on both sides of the bridge reduces scientific silos and could dramatically improve our understanding of child development seen through the lens of a continuum. In what follows, we take up the metaphor of bridge building, synthesizing, and expanding on some of the core themes in the articles in the special issue, including consideration of comparative versus dimensional approaches to the

study of typicality and atypicality. As developmental scientists who are also clinical psychologists, we note that many of the issues raised in the articles resonate with longstanding issues with which clinical psychologists have grappled. We end our commentary with some research considerations for effective bridge building.

TWO ISLANDS: THE CLASSIC COMPARATIVE APPROACH

As noted by Jaswal, Akhtar, and Burack in their introduction to this special issue, the *classic comparison approach*, in which researchers compare the performance of two categorically different groups (i.e., an atypically developing group and a typically developing group) on some task or ability, has been the dominant methodological approach in the field. Implicit in this approach is the assumption that children who possess Condition X, Disorder Y, or Situation Z represent a distinct, nonoverlapping population or category from children who do not have this condition, disorder, or situation. Comparing these two groups on Task A, then, is assumed to yield fundamental insights into the disorder, condition, or situation of interest or insights into how Ability A develops, depending on whether you stand on the atypical or typical side of the bridge.

The use of a group comparison approach has deep roots in developmental psychology that reach far beyond the focus of this special issue on cognitive development in atypical and typical populations. That is, we can see this categorical approach mirrored in classic theoretical discussions within developmental psychology from debates around the distinct roles of nature and nurture in explaining developmental phenomena to debates on the characterization of development as continuous or discontinuous. Although contemporary psychology has largely moved beyond such dichotomized approaches to these core questions, the group comparison approach is endemic in our methodological approaches to questions of cognitive development. That is, much of our knowledge of cognitive development has been built on variants of this approach, from cross-sectional studies comparing children of different ages to studies using median splits to carve children into different groups and to studies comparing children from different cultures or children from typical versus atypical groups.

Why is the classic comparison approach used so frequently to study cognitive development in particular? One reason likely stems from the fact that thinking about distinct groups reflects fundamental aspects of how we, as humans, organize our world. We label people as having blue eyes or brown eyes, we classify life forms according to a taxonomic system, and we group artifacts into categories, etc. And as so thoughtfully articulated in this issue by Dunham and Olson, we seek to impose order on our social world by classifying individuals into discrete social groups. Indeed, it has been demonstrated that the tendency to organize diverse entities into unifying categories and to then use these categories to guide reasoning about shared characteristics and properties of category members emerges early in development (e.g., Baldwin, Markman, & Melartin, 1993; Graham, Kilbreath, & Welder, 2004; Mandler & McDonough, 1996; Vukatana, Graham, Curtin, & Zepeda, 2015). This early-emerging tendency to categorize, combined with evidence that categorical information is easier to remember and reason about, suggests that categorical representations may be privileged in our cognitive system (see Cimpian, 2016; Gelman, 2003, 2004, for reviews and discussion). Put simply, humans find it easier to think about and process information in a categorical fashion.

Second, in the context of research on atypical and typical development, the comparison approach reflects the dominant classification approach that has been applied to mental and

developmental disorders. The two most commonly used systems, the *Diagnostic and Statistical Manual for Mental Disorders - 5th Edition* (DSM-V; APA, 2013) and the World Health Organization (WHO) International Classification of Diseases and Health-Related Problems (WHO, 2016), treat disorders as categories based on a set of defining features. This categorical approach to the assessment of psychological disorders has continued to dominate the fields of psychology and psychiatry, despite considerable research demonstrating that most presenting symptoms exist on a continuum and that most mental disorders are manifestations of an isolated number of underlying dimensions (Esterberg & Compton, 2009; Lahey et al., 2008)—a point we will return to in the next section.

Finally, the ongoing use of a comparison approach is likely sustained by the practical advantages of this approach. Comparing the performance of a group of 2-year-olds with a group of 4-year-old children on a particular cognitive task allows one to collect insights into the unfolding of cognitive development more rapidly. By contrast, longitudinal research is costly, as well as time- and labor-intensive. However, as noted by Paterson, Parish-Morris, Hirsh-Pasek, and Golinkoff in this special issue, despite the practical challenges of longitudinal research, a longitudinal approach does provide a nuanced perspective on the *development* of an individual over time that simply cannot be attained using a cross-sectional comparative approach. Similarly, classifying individuals as having or not having Condition X or as being X or Y is conceptually much simpler and likely easier to implement in research than considering conditions from a more dimensional approach, as noted by Dunham and Olson in their discussion of social categories. Furthermore, in the context of clinical psychology and psychiatry, categories of typical or atypical can create ease in clinical decision making (Widiger & Samuel, 2005). For example, the clinical utility of assigning a child with a particular diagnosis (e.g., depression, conduct disorder) is that a clinician can tailor their treatment approach based on best-practice guidelines or treatment modalities that are supported for that particular diagnosis.

Although the comparison approach has many disadvantages, as we will discuss, the use of this approach has led to seminal insights into multiple aspects of cognitive development. For example, comparisons of deaf and hearing individuals have yielded insights into how early language experiences, or lack thereof, shape the language system and enhance our understanding of the neural bases for language (e.g., Ferjan Ramirez et al., 2014; Goldin-Meadow & Mylander, 1998). Studies comparing children who are blind to those who are sighted have helped us understand the role of sensory experience in the development of spatial and conceptual knowledge (e.g., Bedny & Saxe, 2012; Bigelow, 1996). Another example comes from studies comparing children who are adopted or nonadopted that have demonstrated the importance of the long-term effects of timing of early experiences on many different aspects of development (e.g., Ames, 1997; Rutter et al., 2004). Finally, our understanding of the developmental course of language development in typically developing children has led to the identification of specific difficulties in children not following this path, including children with specific language impairment (SLI; e.g., Bavin, Wilson, Maruff, & Sleeman, 2005; Collisson, Grela, Spaulding, Rueckl, & Magnuson, 2015; Norbury & Bishop, 2002).

The articles in this special issue illustrate the critical insights on children's cognition that can be gained from using the classic comparison approach. For example, Demir-Lira and Levine's (this issue) comparison of children with and without brain lesions helps to unravel the complex and interactive influences of time, socioeconomic status, and the presence versus absence of brain lesions on reading development. Ferrara et al.'s (this issue) findings that people with

Williams syndrome possess the same object-tracking architecture as typically developing individuals highlights the fact that documenting similarities between typical and atypical groups is as informative as uncovering differences.

Despite the knowledge gained through the classic comparison approach, there are clear disadvantages in relying solely on categorical approaches to studying populations or defined characteristics that fall along the spectrum from typical to atypical. As articulated in many of articles in this special issue (Burack et al., this issue; Dunham & Olson, this issue; Jaswal et al., this issue; Paterson et al., this issue), comparing discrete groups tends to focus one's lens on differences rather than on similarities between groups. Yet, as illustrated by Ferrara et al. (this issue), the elucidation of similarities (i.e., an intact multiple-object tracking system) between individuals from atypical groups and typical groups highlights fundamental similarities in the human cognitive system, can describe strengths that can be built upon in the context of interventions, and may also aid in destigmatization of individuals with particular conditions.

Another potential disadvantage of the comparison approach as applied to atypical and typical groups surrounds the reliance on typically developing individuals as the benchmark of normative or typical functioning. As illustrated by Burack et al.'s (this issue) discussion of attention in individuals, this comparative focus, with typically developing individuals as the standard, can lead researchers to overlook ways in which atypical individuals may be advantaged in processing information. In their article, they review findings illustrating that individuals with autism spectrum disorder (ASD) show an earlier evoked response potential mismatch response when compared with typically developing individuals, indicating that the participants with ASD process stimuli differently and more quickly than typically developing individuals. This discussion, of course, raises the critical question of whether typically developing individuals should always be the measuring stick for optimal development—that is, should any deviation in performance from this group be coded as either a deficit or an advantage for members of the atypical group? Consider, for example, the case of the “bilingual advantage,” in which bilinguals outperform monolinguals on measures of executive function. As noted by Akhtar and colleagues (Akhtar & Jaswal, 2013; Akhtar & Menjivar, 2011), in this context, monolinguals are not described as having a deficit in executive function, presumably because monolingualism is seen as normative (a questionable assumption given that a substantial proportion of the world is multilingual). Similarly, the findings that deaf children who use a signed language can discriminate faces better than hearing children (e.g., Bellugi et al., 1990) are typically not interpreted as evidence that hearing children have a deficit in face processing.

A number of articles in the special issue address many of the disadvantages of the comparison approach to studying typical and atypical development. They also provide thoughtful reviews and commentaries on how the science of studying the continuum of cognitive development can be improved so that stimulating ideas and novel insights can be generated and shared with our field. In the next section, we add to this discussion by highlighting the practical, conceptual, and empirical advantages of dimensional approaches to understanding child development and cognition.

BRIDGING THE ISLANDS: DIMENSIONAL APPROACHES

Whereas *comparative approaches* tend to classify individuals into categorically distinct groups, *dimensional approaches* aim to study the full spectrum of variation, ranging from typical to

atypical, on a given construct or in a diverse population of individuals with the understanding that knowledge gleaned on both typical and atypical development is mutually informative (Cicchetti & Toth, 2006). In dimensional approaches, an index is provided marking an individual's relative position compared to others. For example, a dimensional approach to understanding child attention involves ascertaining one child's relative standing compared to other children in a given population (Fox & Henderson, 1999). Of course, identifying the relevant population for comparison for a given child is a nontrivial task. Nonetheless, this approach lends itself well to the study of typical and atypical development, as it more closely reflects the reality of individual variation within a population.

The debate between dimensional and categorical approaches has a long history in psychiatry and clinical psychology (e.g., Nigg, 2015). As noted earlier, the traditional approach to studying clinical conditions has been deeply rooted in the medical model. From a medical perspective, disease conditions are often considered categorical in nature (e.g., presence or absence of diabetes, cancer, or Parkinson disease, etc.). In the formulation of some diagnosable mental disorders, a similar classification approach to the medical literature is applied, in that a symptom, such as psychosis, is either present or not. This categorization of mental disorders is based on an individual meeting a minimum threshold on a set of diagnostic criteria. Traditionally, the classification of mental disorders has been a helpful practical approach to diagnosis, as it can determine the need for treatment and the type of treatment that should be received. Of course, one problem with this categorical approach is the use of artificial boundaries in carving symptoms into categories. For example, two children, one just meeting and one just failing to meet diagnostic criteria, will be treated as categorically distinct when these two children may, in fact, be more similar than they are different. Moreover, the need for children to meet a certain symptomatic threshold to receive a diagnosis may limit the availability of resources and services accessible to children who are struggling but who fall below this clinically significant threshold.

In addition to this more practical issue of classifying children into diagnostic groups, there are conceptual issues such as overlapping diagnostic criteria and the high frequency of diagnostic comorbidity (e.g., Cantwell, 1996; Caron & Rutter, 1991; Hudziack, Achenbach, Althoff, & Pine, 2007). Indeed, the prevalence of diagnostic comorbidities in children (i.e., the co-occurrence of two or more diagnoses) is high: 40% of children who receive one DSM diagnosis meet criteria for a second diagnosis (Krueger, Caspi, Moffitt, & Silva, 1998). The overlap in psychiatric nosology has led to substantial debate on whether psychopathology is a categorical or dimensional construct. This debate has generated research endeavors that explicitly test whether the underlying latent dimensions of the most common forms of childhood mental disorders are best characterized as categorical or dimensional. For example, Lahey et al. (2008) conducted a confirmatory factor analysis in a large representative sample of children to determine the structural model of child psychopathology. They found that the most common forms of child psychopathology are highly correlated with one another. Specifically, 68% to 82% of the variance in children's attention-deficit hyperactivity disorder (ADHD), conduct disorder, and oppositional defiant disorder could be explained by a higher-order dimension of "externalizing behavior," and 44% to 76% of the variance for the anxiety disorders and major depressive disorder dimension could be explained by a higher-order dimension of "internalizing" behavior. Together, these findings lend support to the prevailing view that disorders are not independent from one another but rather are substantially correlated. An analogy to this finding can be found in the field of cognitive development, in that variance in children's cognitive abilities can be

explained by an underlying “g” factor, despite the practice of separating abilities into distinct groups (e.g., verbal comprehension, visual spatial skills, working memory, etc.; Caspi et al., 2014).

The debate on categorical versus dimensional models for understanding and treating psychopathology will likely continue to be fiercely discussed in the literature, with a current focus on the contrast between the *DSM - Fifth Edition* and National Institute of Mental Health (NIMH) Research Domain Criteria (RDoC; e.g., Casey et al., 2013; Frances & Widiger, 2012; Insel, 2014; Nigg, 2015). Briefly, the RDoC takes a dimensional approach to psychopathology and focuses on transdiagnostic features rather than categories and places particular emphasis on developmental trajectories. This debate has pushed the boundaries of psychopathological research, much to the advantage of scientists seeking to uncover the etiology of child psychopathology, but also to the advantage of children and their families who are seeking to attain clarity about the nature, course, and treatment of overlapping symptomatology. Certainly, information garnered from the developmental psychopathology literature suggests that the process of categorizing conditions is not only highly complex, but may fail to highlight the existing variations in the symptoms, signs, and course of a particular disorder.

In line with the clinical literature discussed earlier regarding the underlying dimensional nature of psychopathology, several articles in this special issue take up the notion that classification of cognitive functions as being either an ability or a deficit, or typical or atypical, does not capture the fundamental variability that exists in these capacities. As noted by Burack et al. (this issue), attention and executive functioning in children are best characterized as flexible and adaptive, and they are highly dependent on the ongoing dynamic interactions between individuals and their contextual environments. For example, a child may be able to maintain focused attention for a longer period of time if Conditions X, Y, and Z are met. Another clear demonstration of this viewpoint can be derived from research demonstrating that children enduring deprivation at an early age can demonstrate degrees of recovery in neurocognitive functioning if placed in more contextually enriched environments (Nelson et al., 2007). If cognitive functions are only examined in categorical terms, such as being either typical or atypical, improvements in functioning due to contextual change may not be adequately captured. The Landry and Chouinard article in this special issue presents a model in which milder personality and cognitive autistic traits (i.e., broader autism phenotype [BAP]) are presented dimensionally. As the authors note, this model offers a number of advantages in the quest to understand ASD. We would add that this model might also help with the development and implementation of treatment strategies for individuals who may manifest one core aspect of BAP, which may, in turn, inform ASD treatments. Moreover, although individuals who manifest high BAP features, such as difficulties in social communication, may not receive a diagnosis of ASD, the need for clinical intervention to facilitate the amelioration of potential deficits may still exist, and a more dimensional view of ASD may enable greater access to these services.

In their article, Paterson et al. (this issue) offer persuasive evidence that even small contextual changes early in life can have a cascading influence on the variation displayed in functions and behaviors throughout childhood, thereby underscoring the need to study cognitive functions dimensionally to determine the degree of variation and/or change over time. Finally, Dunham and Olson (this issue) provide a thoughtful discussion of how social categories, often considered discrete, can (and should) be considered from a dimensional perspective and provide a

compelling argumentation on how such a dimensional approach will enhance both clinical and developmental science.

Our comments, together with the articles in this special issue, are meant to increase recognition of the value of researching typical and atypical cognitive development as a continuum rather than discrete categorization. In the next section, we close by highlighting some considerations for how to effectively bridge the two islands known herein as typical and atypical development.

BUILDING BRIDGES: CONSIDERATION FOR FUTURE RESEARCH ENDEAVORS

Consider a Dimensional Approach

To paraphrase a familiar saying, one approach will not fit all research questions. However, when examining typical and atypical development, we would encourage researchers to consider a dimensional approach when possible and, if impossible, to note it as a potential study limitation. As discussed earlier and as so clearly articulated in a number of the articles in this special issue, there are clear theoretical reasons to embrace this dimensional approach.

From a methodological perspective, dimensional approaches to statistical analyses are considered to be more powerful, and arguably more valid, compared with categorical approaches to understanding phenomena. The practice of categorizing and comparing variables or populations as “typical” or “atypical” can lead to a loss of information and/or inappropriate classification of individuals. For example, if a sample of participants is split at the mean (or median) of the distribution, with those above the distribution considered typical and those below considered atypical, misclassification is most likely to occur among the participants clustered around the mean. As a result, participants who are statistically similar are treated as categorically different based on a small cut-point difference. This practice of dichotomization has the potential to lead to misunderstanding of the relation between variables in developmental science, which in turn has considerable implications for the translation of knowledge to practice and policy (Dawson & Weiss, 2012). For example, if results from analyses that divided typical and atypical at a designated cut point (e.g., mean) revealed differences between the two groups in terms of degree of deficits (i.e., language delay, intelligence) or level of symptomatology (e.g., inattention), the clinical recommendations may be to treat these “typical” and “atypical” groups as qualitatively different. Thus, children falling on the atypical side of the cut point may have access to specialized services to attenuate deficits or symptomatology, while those falling on the typical side may not have the same privileged access to such services as they failed to meet the designated threshold, but as noted previously, the degree of deficit and level of symptomatology of those clustering around the mean may be more similar than they are different.

Consider When the Group Comparison Approach Is Most Appropriate

When using the comparative approach to studying typical and atypical development, a consideration should be made as to when this method is best employed. As illustrated by the Demir-Lira and Levine (this issue) and Ferrara et al. (this issue) articles, this approach may be best utilized when the presence or absence of a condition is more easily characterized, like a condition (deafness, brain lesion, chromosomal abnormality), as opposed to creating cut points

of typical or atypical on constructs (e.g., attention, working memory) that are best captured as dimensional in nature.

A viable avenue for attaining a greater understanding of whether a construct is best captured as categorical or dimensional is a data-analytic tool called taxometric analysis. Taxometric research seeks to determine whether a set of indicators correlate in a manner more consistent with a distinction as dimensional or categorical (Waller & Meehl, 1998). To date, taxometric research has largely been conducted in the clinical literatures, such as the research described by Lahey et al. (2008) on the underlying dimensions of psychopathology. Another example from this field of research, which has relevancy for the examination of attention in cognitive development, stems from research by Marcus and Barry (2011) who sought to examine the widespread notion that ADHD is a discrete condition. They applied a taxometric analysis to data from the National Institute of Child Health and Human Development Study of Early Child Care and Youth Development and found that ADHD symptoms have a dimensional rather than categorical structure. The taxometric approach has also been applied to developmental and cognitive-related constructs as well. For example, Fraley and Spieker (2003) as well as Roisman, Fraley, and Belsky (2007) examined the latent structure of two core measures of attachment theory—the strange situation paradigm (Ainsworth, Blehar, Waters, & Wall, 1978) and the Adult Attachment Interview (George, Kaplan, & Main, 1985), respectively—which have traditionally coded patterns of attachment using a categorical approach that are derived from a set of continuous rating scales. Results from the taxometric analyses revealed that the measurement of individual differences in infant and adult attachment is continuously rather than categorically distributed. Finally, Dollaghan (2004) applied a taxometric analysis to the study of SLI in children aged 3 and 4 years to determine if the distribution of scores on a set of language measures supported the discrete categorization of SLI; however, a qualitatively distinct group of language impairment (i.e., SLI taxon) was not supported. Together, these studies underscore the need to approach the study of typical and atypical development with a mindset that, unlike most disease conditions, psychological phenomena are empirically most consistent with a dimensional perspective.

Use Multiple Methods and Time Points

In keeping with Paterson et al.'s (this issue) thoughtful discussion, we too suggest that researchers consider the use of multiple methods to capture both similarities and differences in the context of typical and atypical development. Paterson et al. aptly illustrate several examples of how a multimethod approach to cognitive development can shed light on complex processes that may have been otherwise missed empirically if a monomethod approach was utilized. Similarly, the use of multiple time points is an essential study design element to effectively illustrate the *development* of cognition. Moreover, individual variation in cognitive development is ubiquitous, and longitudinal study designs are necessary to examine the unfolding of these individual differences over time.

Consider Clinical Significance

As highlighted by a number of articles in this special issue, differences between typical and atypical groups, when detected, are often coded as deficits without consideration of context, relevance, and meaning (Akhtar & Jaswal, 2013; Burack et al., this issue; Jaswal et al., 2016; Medin, Bennis, &

Chandler, 2010). Yet construing any difference in performance or ability as reflecting a deficit in the atypical population fails to consider the difference between *statistical significance* and *clinical significance*. The term clinical significance is typically used in clinical psychology to index whether treatment effects yield meaningful differences in an individual's everyday life (Jacobson & Truax, 1991; Kazdin, 1999). That is, psychotherapy researchers have argued that the existence of a statistical difference between groups only demonstrates that this difference cannot be attributed to chance; it does not signal, however, whether this difference is important or meaningful.

Within clinical psychology, considerable effort has been dedicated toward defining clinical significance (e.g., determining whether treated individuals are indistinguishable from individuals from the general population; determining whether impairment has been reduced; Kazdin, 1999) and implementing measures of clinical significance that go beyond effect sizes and statistical significance (e.g., the Reliable Change Index; Jacobson, Follette, & Revenstorf, 1984). Drawing on this literature, we suggest that any consideration of differences between typical and atypical individuals needs to entail attention toward a construct like clinical significance. That is, does this difference reflect a meaningful impact on everyday functioning for an individual? Is this difference meaningfully related to the critical mechanisms that underpin a condition or disorder? If considering a clinical group, does this difference between the typical and atypical groups inform treatment options and selection?

CONCLUSIONS

The articles in this special issue have illustrated the advantages of creating connections between researchers who study cognitive development from a variety of perspectives. In our commentary, we have highlighted the benefits of adopting dimensional approaches when studying typical and atypical development. At the same time, we acknowledge the benefits of the comparative approach—not all questions lend themselves either conceptually or practically to a dimensional approach. Collectively, this special issue constitutes an important step in recognizing the value of examining cognitive development using a broader lens that encompasses two mutually informative constructs: typical and atypical development. We are optimistic that this special issue will serve as an impetus for stimulating and novel research on the full continuum of cognitive development in the years to come.

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REFERENCES

- Ainsworth, M., Blehar, M. C., Waters, E., & Wall, S. (1978). *Patterns of attachment: A psychological study of the strange situation*. Hillsdale, NJ: Erlbaum.
- Akhtar, N., & Jaswal, V. K. (2013). Deficit or difference? Interpreting diverse developmental paths: An introduction to the special section. *Developmental Psychology*, 49, 1–3. doi:10.1037/a0029851
- Akhtar, N., & Menjivar, J. A. (2011). Cognitive and linguistic correlates of early exposure to more than one language. *Advances in Child Development and Behavior*, 42, 41–78.
- American Psychiatric Association (APA). (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). Washington, DC: Author.
- Ames, E. (1997). The development of Romanian orphanage children adopted to Canada. Final report to Human Resources Development Canada. Burnaby, BC: Simon Fraser University.
- Baldwin, D. A., Markman, E. M., & Melartin, R. L. (1993). Infants' ability to draw inferences about nonobvious object properties: Evidence from exploratory play. *Child Development*, 64, 711–728. doi:10.2307/1131213
- Bavin, E. L., Wilson, P. H., Maruff, P., & Sleeman, F. (2005). Spatio-visual memory of children with specific language impairment: Evidence for generalized processing problems. *International Journal of Language & Communication Disorders*, 40, 319–332. doi:10.1080/13682820400027750
- Bedny, M., & Saxe, R. (2012). Insights into the origins of knowledge from the cognitive neuroscience of blindness. *Cognitive Neuropsychology*, 29, 56–84. doi:10.1080/02643294.2012.713342
- Bellugi, U., O'Grady, L., Lillo-Martin, D., Hynes, M. G., Van Hoek, K., & Corina, D. (1990). Enhancement of spatial cognition in deaf children. In V. Volterra & C. Erting (Eds.), *From gesture to language in hearing and deaf children* (pp. 278–298). New York: Springer-Verlag.
- Bigelow, A. E. (1996). Blind and sighted children's spatial knowledge of their home environments. *International Journal of Behavioral Development*, 19, 797–816. doi:10.1177/016502549601900407
- Cantwell, D. P. (1996). Classification of child and adolescent psychopathology. *Journal of Child Psychology and Psychiatry*, 37(1), 3–12.
- Caron, C., & Rutter, M. (1991). Comorbidity in child psychopathology: Concepts, issues and research strategies. *Journal of Child Psychology and Psychiatry*, 32(7), 1063–1080.
- Casey, B. J., Craddock, N., Cuthbert, B. N., Hyman, S. E., Lee, F. S., & Ressler, K. J. (2013). DSM-5 and RDoC: Progress in psychiatry research? *Nature Reviews Neuroscience*, 14, 810–814. doi:10.1038/nrn3621
- Caspi, A., Houts, R. M., Belsky, D. W., Goldman-Mellor, S. J., Harrington, H., Israel, S., ... & Moffitt, T. E. (2014). The p factor one general psychopathology factor in the structure of psychiatric disorders?. *Clinical Psychological Science*, 2(2), 119–137.
- Cicchetti, D., & Toth, S. L. (2006). Building bridges and crossing them: Translational research in developmental psychopathology. *Development and Psychopathology*, 18, 619–622. doi:10.1017/S0954579406060317
- Cimpian, A. (2016). The privileged status of category representations in early development. *Child Development Perspectives*, 10, 99–104. doi:10.1111/cdep.2016.10.issue-2
- Collisson, B. A., Grela, B., Spaulding, T., Rueckl, J. G., & Magnuson, J. S. (2015). Individual differences in the shape bias in preschool children with specific language impairment and typical language development: Theoretical and clinical implications. *Developmental Science*, 18, 373–388. doi:10.1111/desc.2015.18.issue-3
- Dawson, N. V., & Weiss, R. (2012). Dichotomizing continuous variables in statistical analysis: A practice to avoid. *Medical Decision Making*, 32, 225–226. doi:10.1177/0272989X12437605
- Dollaghan, C. A. (2004). Taxometric analyses of specific language impairment in 3- and 4-year-old children. *Journal of Speech, Language, and Hearing Research*, 47, 464–475. doi:10.1044/1092-4388(2004)037
- Esterberg, M. L., & Compton, M. T. (2009). The psychosis continuum and categorical versus dimensional diagnostic approaches. *Current Psychiatry Reports*, 11, 179–184. doi:10.1007/s11920-009-0028-7
- Ferjan Ramirez, N., Leonard, M. K., Davenport, T., Torres, C., Halgren, E., & Mayberry, R. I. (2014). Neural language processing in adolescent first-language learners: Longitudinal case studies in American Sign Language. *Cerebral Cortex*, 26, 1015–1026.
- Fox, N. A., & Henderson, H. A. (1999). Does infancy matter? Predicting social behavior from infant temperament. *Infant Behavior and Development*, 22, 445–455. doi:10.1016/S0163-6383(00)00018-7
- Fraley, R. C., & Spieker, S. J. (2003). Are infant attachment patterns continuously or categorically distributed? A taxometric analysis of strange situation behavior. *Developmental Psychology*, 39, 387–404. doi:10.1037/0012-1649.39.3.387

- Frances, A. J., & Widiger, T. (2012). Psychiatric diagnosis: Lessons from the DSM-IV past and cautions for the DSM-5 future. *Annual Review of Clinical Psychology*, 8, 109–130. doi:10.1146/annurev-clinpsy-032511-143102
- Gelman, S. A. (2003). *The essential child: Origins of essentialism in everyday thought*. New York, NY: Oxford University Press.
- Gelman, S. A. (2004). Psychological essentialism in children. *Trends in Cognitive Sciences*, 8, 404–409. doi:10.1016/j.tics.2004.07.001
- George, C., Kaplan, N., & Main, M. (1985). *The Berkeley Adult Attachment Interview*. Unpublished protocol, Department of Psychology, University of California, Berkeley.
- Goldin-Meadow, S., & Mylander, C. (1998). Spontaneous sign systems created by deaf children in two cultures. *Nature*, 391, 279–281. doi:10.1038/34646
- Graham, S. A., Kilbreath, C. S., & Welder, A. N. (2004). Thirteen-month-olds rely on shared labels and shape similarity for inductive inferences. *Child Development*, 75, 409–427. doi:10.1111/cdev.2004.75.issue-2
- Hudziak, J. J., Achenbach, T. M., Althoff, R. R., & Pine, D. S. (2007). A dimensional approach to developmental psychopathology. *International Journal of Methods in Psychiatric Research*, 16(S1), S16–S23.
- Insel, T. R. (2014). The NIMH research domain criteria (RDoC) project: precision medicine for psychiatry. *American Journal of Psychiatry*, 171, 395–397.
- Jacobson, N. S., Follette, W. C., & Revenstorf, D. (1984). Psychotherapy outcome research: Methods for reporting variability and evaluating clinical significance. *Behavior Therapy*, 15, 336–352. doi:10.1016/S0005-7894(84)80002-7
- Jacobson, N. S., & Truax, P. (1991). Clinical significance: A statistical approach to defining meaningful change in psychotherapy research. *Journal of Consulting and Clinical Psychology*, 59, 12–19. doi:10.1037/0022-006X.59.1.12
- Kazdin, A. E. (1999). The meanings and measurement of clinical significance. *Journal of Consulting and Clinical Psychology*, 67, 332–339. doi:10.1037/0022-006X.67.3.332
- Krueger, R. F., Caspi, A., Moffitt, T. E., & Silva, P. A. (1998). The structure and stability of common mental disorders (DSM-III-R): A longitudinal-epidemiological study. *Journal of Abnormal Psychology*, 107, 216–227. doi:10.1037/0021-843X.107.2.216
- Lahey, B. B., Rathouz, P. J., Van Hulle, C., Urbano, R. C., Krueger, R. F., Applegate, B., & Waldman, I. D. (2008). Testing structural models of DSM-IV symptoms of common forms of child and adolescent psychopathology. *Journal of Abnormal Child Psychology*, 36, 187–206. doi:10.1007/s10802-007-9169-5
- Mandler, J. M., & McDonough, L. (1996). Drinking and driving don't mix: Inductive generalization in infancy. *Cognition*, 59, 307–335. doi:10.1016/0010-0277(95)00696-6
- Marcus, D. K., & Barry, T. D. (2011). Does attention-deficit/hyperactivity disorder have a dimensional latent structure? A taxometric analysis. *Journal of Abnormal Psychology*, 120, 427–442. doi:10.1037/a0021405
- Medin, D., Bennis, W., & Chandler, M. (2010). Culture and the home-field disadvantage. *Perspectives on Psychological Science*, 5, 708–713. doi:10.1177/1745691610388772
- Nelson, C. A., Zeanah, C. H., Fox, N. A., Marshall, P. J., Smyke, A. T., & Guthrie, D. (2007). Cognitive recovery in socially deprived young children: The Bucharest Early Intervention Project. *Science*, 318, 1937–1940. doi:10.1126/science.1143921
- Nigg, J. T. (2015). Editorial: The shape of the nosology to come in developmental psychopathology. *Journal of Child Psychology and Psychiatry*, 56, 397–399. doi:10.1111/jcpp.2015.56.issue-4
- Norbury, C. F., & Bishop, D. V. (2002). Inferential processing and story recall in children with communication problems: A comparison of specific language impairment, pragmatic language impairment and high-functioning autism. *International Journal of Language & Communication Disorders*, 37, 227–251. doi:10.1080/13682820210136269
- Roisman, G. I., Fraley, R. C., & Belsky, J. (2007). A taxometric study of the Adult Attachment Interview. *Developmental Psychology*, 43, 675–686. doi:10.1037/0012-1649.43.3.675
- Rutter, M., O'Connor, T. G., & English and Romanian Adoptees (ERA) Study Team. (2004). Are there biological programming effects for psychological development? Findings from a study of Romanian adoptees. *Developmental Psychology*, 40(1), 81.
- Vukatana, E., Graham, S. A., Curtin, S., & Zepeda, M. S. (2015). One is not enough: Multiple exemplars facilitate infants' generalizations of novel properties. *Infancy*, 20, 548–575. doi:10.1111/inf.2015.20.issue-5
- Waller, N. G., & Meehl, P. E. (1998). *Multivariate taxometric procedures: Distinguishing types from continua*. Thousand Oaks, CA: Sage Publications, Inc.
- Widiger, T. A., & Samuel, D. B. (2005). Diagnostic categories or dimensions? A question for the Diagnostic and Statistical Manual of Mental Disorders. *Journal of Abnormal Psychology*, 114, 494–504. doi:10.1037/0021-843X.114.4.494
- World Health Organization (WHO). (2016). *ICD-10: International statistical classification of diseases and related health problems (Volume 2, Instruction Manual, 5th ed.)*. Geneva, Switzerland: World Health Organization.