
BIOGRAPHICAL SKETCH

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NAME: Tiffany Woynaroski

eRA COMMONS USER NAME (credential, e.g., agency login): woynartg

POSITION TITLE: Assistant Professor

EDUCATION/TRAINING (*Begin with baccalaureate or other initial professional education, such as nursing, include postdoctoral training and residency training if applicable. Add/delete rows as necessary.*)

INSTITUTION AND LOCATION	DEGREE (if applicable)	Completion Date MM/YYYY	FIELD OF STUDY
Valparaiso University, Valparaiso, IN	B.S.	2002	Psychology
Vanderbilt University, Nashville, TN	M.S.	2009	Speech-Language Pathology
Vanderbilt University, Nashville, TN	Ph.D.	2014	Hearing and Speech Sciences

A. Personal Statement

I have extensive clinical experience working with young children with autism spectrum disorder (ASD) and other intellectual and developmental disabilities (IDD), as an early interventionist/parent educator, speech language pathologist, and autism consultant. I am additionally the parent of a handsome and brilliant young man on the spectrum. These clinical and personal experiences led me to pursue an academic career. My interdisciplinary research identifies brain and behavioral factors that (a) explain heterogeneity in symptomatology, (b) predict growth and response to treatment, and (c) evaluate how/why treatment works in young children with IDD. To date, I have 24 publications on these topics. One line of my research has focused on sensory function, and its relation to other core and related ASD symptomatology in children diagnosed with or at risk for ASD. I have 9 publications (2 in press) on this topic, and am presently the PI of a Clinical and Translational Career Development Award (KL2) that is using EEG/ERPs to examine the role of sensory function in spoken language of young children with ASD; PI on an R21 that extends this work to examine the association between early sensory function and later social communication and language of infants at high risk for ASD; and key personnel on Vanderbilt's U54 research project examining sensory and multisensory function in children and adolescents with ASD. I have collaborated extensively with Drs. Cascio and Broderick at VUMC, as well as with Drs. Baranek and Watson at USC and UNC, respectively, on projects involving children diagnosed with or at risk for ASD. The proposed project brings together this exceptional interdisciplinary team to examine the biobehavioral substrates and developmental sequelae of atypical sensory responsiveness in infants at heightened risk for a future diagnosis of autism. If our hypotheses are born out, this line of research has the potential to facilitate the early identification and remediation of ASD and related symptomatology, and thereby to improve long-term outcomes of, children with or at-risk for ASD.

- **Woynaroski, T.***, Damiano, C.*, Simon, D., Ibanez, L., Murias, M., Wallace, M.T., Stone, W.L., & **Cascio, C.** (2018). Developmental sequelae and neurophysiological substrates of sensory seeking in infants at heightened risk for autism spectrum disorder. *Developmental Cognitive Neuroscience*. doi: 10.1016/j.dcn.2017.08.005. *Authors made equal contributions
- **Woynaroski, T.***, **Baranek, G.***, Nowell, S., Turner Brown, L., DuBay, M., Crais, E., & **Watson, L.** (2018). Cascading effects of attention disengagement and sensory seeking on social symptoms in a community sample of infants at-risk for a future diagnosis of autism spectrum disorder. *Developmental Cognitive Neuroscience*. doi: 10.1016/j.dcn.2017.08.006. *Authors made equal contributions
- Simon, D., Damiano, C., **Woynaroski, T.**, Ibanez, L., Murias, M., Wallace, M.T., Stone, W.L., & **Cascio, C.** (2017). Neural correlates of sensory hyporesponsiveness in toddlers at high risk for autism spectrum disorder. *Journal of Autism and Developmental Disabilities*. doi: 10.1007/s10803-017-3191-4.
- **Cascio, C.**, **Woynaroski, T.**, **Baranek, G.**, & Wallace, M. T. (2016). Toward an interdisciplinary approach to understanding sensory function in autism spectrum disorder. *Autism Research*.

B. Select Academic and Professional Honors

Trainee, Clinical Specialty Preparation to Serve Infants, Toddlers, and Children With Feeding and Swallowing Disabilities, Vanderbilt University, US Department of Education Personnel Preparation Grant, 2007-2009
Vanderbilt University Graduate School Harold Stirling Vanderbilt Scholarship, 2010-present
Trainee, US Department of Education Training Grant, Preparing Teachers/Scholars in Language and Literacy (H325D080075; PI: Schuele), 2010-2014
Student Research Travel Grant, Vanderbilt University Graduate School, 2012, 2013, 2014
Vanderbilt Kennedy Center Trainee Student Travel Grant, 2013
David Zeaman Travel Award for the Gatlinburg Conference on Intellectual Disabilities, 2014
Vanderbilt University Faculty Research Scholars Award, 2015
Vanderbilt Clinical and Translational Research Scholar, 2015-present
Newman Scholar, 2015-present
Burroughs-Wellcome Translational Scholar Award, 2016
IDDRC Exchange Award, 2016
American Speech-Language-Hearing Association Research Mentor Award, 2017
Professional Affiliations:
American Speech-Language-Hearing Association
Vanderbilt Kennedy Center – Investigator
Vanderbilt Brain Institute

C. Contributions to Science

1. Demonstrated that a new, automated method of measuring children’s vocal development is highly stable and valid for predicting word use of minimally verbal preschoolers with ASD.

This line of research has focused on how measurement of vocalizations (i.e., the sounds that children make before they are using words to communicate) can be used to predict language outcomes of children with ASD. Theory and evidence from a fairly large literature had previously demonstrated that children follow a predictable path through “universal stages of vocal development” as they progress towards language use. Previous work had also shown that conventional indices of vocalizations, derived by collecting and coding fairly limited vocal samples, predicted language outcomes in many populations, including children with ASD. However, the large amount of time and high cost involved in the collection and coding of these conventional samples precluded measurement of vocal development in clinical practice. My dissertation and subsequent work, carried out in collaboration with leading experts in prelinguistic vocal development and automated vocal analysis, showed that we can use automated indices of vocal development, derived by collecting day-long samples of vocalizations with a small digital recorder worn in the pocket of a special T-shirt, to predict the later language of children with ASD in the early stages of language development. One automated score that we have developed predicts later word use of minimally verbal preschoolers with ASD “as good as” indices derived via the conventional approach. The more time-effective and cost-efficient automated method may ultimately make it possible for clinicians to measure vocal development in everyday practice. I am the first author on this body of work. To date, I have published my doctoral dissertation on this topic, disseminated findings from this work at many scientific meetings, and published a manuscript on the psychometrics of automated vocal analysis in minimally verbal preschoolers with ASD to *Autism Research*.

- **Woynaroski, T.** (2014). *The stability and validity of automated vocal analysis in preschoolers with autism spectrum disorder in early stages of language development* (Doctoral dissertation). Retrieved from <http://etd.library.vanderbilt.edu/>. (URN: 11252014-15182).
- **Woynaroski, T.**, Oller, D.K., Keceli-Kaysili, B., Xu, D., Richards, J.A., Gilkerson, J., & Gray, S., Yoder, P.J. (2016). The stability and validity of automated vocal analysis in minimally verbal preschoolers with autism spectrum disorder. *Autism Research*. [PMID: 27459107]

2. Identified predictors of vocal development and mechanisms by which vocal development influences later language of children with ASD and other developmental disabilities.

Children’s prelinguistic and linguistic development does not occur in a vacuum. Transactional theory suggests that models that consider parent and child factors, and the dynamic way in which they interact with one another, should best explain individual differences in early language development. This account of language development had seemingly been widely accepted, but surprisingly not previously tested in children with autism and other developmental disabilities. My work in this area, carried out in collaboration

with Paul Yoder and others, has provided empirical support for the transactional model of language learning in both children with intellectual disabilities (published), as well as children with ASD (submitted for presentation at upcoming scientific meetings and in preparation for submission to *Child Language*). These longitudinal correlational investigations have shown that early child vocalizations used in communication elicit parent linguistic responses, which in turn support language learning. We have further demonstrated that early intervention may boost vocal development to jumpstart this dynamic language learning mechanism in children with developmental disabilities. Another one of our recent studies has shown that children's motivation to communicate and parent's linguistic input also influence children's vocal development. I am first author on these studies, which are important because a) they increase our understanding of factors and mechanisms that influence early vocal development and language learning and b) they suggest how we might best intervene to support language acquisition in children with developmental disabilities.

- **Woynaroski, T.**, Yoder, P., Fey, M., Warren, S. (2014). A transactional model of spoken vocabulary variation in toddlers with intellectual disabilities. *Journal of Speech, Language, and Hearing Research*, 57, 1754-1763. [NIHMSID 586204; PMID: 24802090; PMCID: PMC4192117]
- **Woynaroski, T., Watson, L.**, Gardner, E., Newsom, C., Keceli-Kaysili, B., Yoder, P. (2015). Early predictors of growth in diversity of key consonants used in communication in initially preverbal children with autism spectrum disorder. *Journal of Autism and Developmental Disabilities*, 46(3), 1013-1024. [PMID: 26603885]
- Harbison, A. L., **Woynaroski, T. G.**, Tapp, J., Wade, J. W., Warlaumont, A. S., & Yoder, P. J. (2018). A new measure of child vocal reciprocity in children with autism spectrum disorder. *Autism Research*.

3. Demonstrated that more intense treatment yields better language outcomes for some children with developmental disabilities, in part by boosting children's prelinguistic vocal development.

In my predoctoral work and ongoing collaborations with Paul Yoder, I have additionally contributed to our collective knowledge re: the effects of treatment intensity (i.e., the amount of treatment provided) on language outcomes of children with developmental disabilities. Prior to this work, there had been no systematic research into the effects of treatment intensity on language and communication outcomes of children with developmental disabilities. This research revealed that some children with developmental disabilities, such as children with Down syndrome, achieve more optimal language outcomes when they receive 5 hours of intervention per week versus only 1 hour of intervention per week. Subsequent analyses revealed that the effect of more intense treatment on language outcomes of children with Down syndrome was preceded and mediated by earlier effects on children's vocal communication and receptive vocabulary. Thus, changes in children's vocalizations and language understanding may serve as early indicators that increased treatment intensity is "working" to improve language outcomes. I am first author on an in-press chapter summarizing the findings from this seminal study of treatment intensity in developmental disabilities and co-author on the peer-reviewed articles stemming from this work. I have further worked to disseminate these results, which point to the need for personalized treatment planning for this population, at scientific meetings reaching the broad range of disciplines with an interest in developmental disabilities, in regional meetings reaching parents and service providers, and via partnership on a unique project called "Kindred Stories" that is intended to convey the findings of this research to policy makers and the public at large. Thus, my work in this area highlights my commitment to translation of findings from research to practice.

- **Woynaroski, T.**, Fey, M., Warren, S., & Yoder, P. (2016). Prelinguistic communication intervention research: a focus on treatment intensity. In M. Ronski & R. Sevcik (Eds.), *Examining the science and practice of communication interventions for individuals with severe disabilities*. Baltimore, MD: Brookes Publishing.
- Yoder, P., **Woynaroski, T.**, Fey, M., & Warren, S. (2014). Effects of dose frequency of early communication intervention in young children with and without Down syndrome. *American Journal of Intellectual and Developmental Disabilities*, 119, 17 – 32. doi: 10.1352/1944-7558-119.1.17. [NIHMSID: 586088. PMID: 24450319]
- Yoder, P., **Woynaroski, T.**, Fey, M., Warren, S., Gardner, E. (2015). Why dose frequency affects spoken vocabulary in preschoolers with Down syndrome. *American Journal of Intellectual and Developmental Disabilities*, 120(4), 302-314. [PMID: 26161468]

- Yoder, P., & **Woynaroski, T.** (2014). How to study the influence of intensity of treatment on generalized skill and knowledge acquisition in students with disabilities. *Journal of Behavioral Education*, 24(1), 152-166. [PMID: 25914513; PMCID: PMC4405899]

4. Detailed the nature of sensory disturbances, and related these sensory differences to deficits in communication, in children and adults with autism.

Even when we account for all of the previously identified predictors of language in individuals with ASD, we are unable to explain the majority of the variance in this population. This has led me to consider whether other factors, such as sensory differences, might account for some of the variability that remains unaccounted for. Differences in responding to sensory stimuli were noted even in the earliest accounts of autism and have been commonly observed in, or reported by, individuals with ASD since that time. It has been proposed that “foundational” sensory differences could underlie deficits in higher-order cognitive, linguistic, and social deficits in ASD. However, there has been surprisingly little empirical work focused on identifying the nature of sensory differences in ASD, or on understanding how they may contribute to the well-established deficits in higher-order abilities in individuals with ASD. In the course of my predoctoral work with Mark Wallace, Ph.D., I found that integration and perception of audiovisual speech were associated with broader behavioral characteristics of ASD, such as communication skill and sensory profile, in children with ASD. This study and related work from continued collaborations with Dr. Wallace and colleagues has yielded numerous peer-reviewed publications in journals such as *Journal of Autism and Developmental Disabilities* and *Journal of Neuroscience*. My ongoing research in this area seeks to a) extend our prior work to younger and lower-functioning children with ASD, b) evaluate whether early differences in sensory function produce cascading effects on later social communication and language abilities, c) determine whether sensory differences improve our understanding of variability in language after we have controlled for factors, such as vocal development and parent linguistic input, that have been identified as value-added predictors of useful speech, and d) test whether targeting sensory differences may translate to improved social communication and language outcomes for children with ASD.

- **Woynaroski, T.**, Kwakye, L. D., Foss-Feig, J. H., Stevenson, R. A., Stone, W. L., & Wallace, M. T. (2013). Multisensory speech perception in children with autism spectrum disorders. *Journal of Autism and Developmental Disorders*, 43(12), 2891-2902. doi: 10.1007/s10803-013-1836-5. [PMID: 23624833; PMCID: PMC3998667]
- **Cascio, C.**, **Woynaroski, T.**, **Baranek, G.**, & Wallace, M. T. (2016). Toward an interdisciplinary approach to understanding sensory function in autism spectrum disorder. *Autism Research*.
- Stevenson, R., Siemann, J. K., **Woynaroski, T.**, Schneider, B. C., Eberly, H. E. Camarata, S. M., & Wallace, M. T. (2014). Multisensory temporal integration in autism spectrum disorders. *Journal of Neuroscience*, 34(3), 691-697. doi: 10.1523/JNEUROSCI.3615-13.201434/3/691 [pii]. [PMID: 24431427; PMCID: PMC3891950]
- Feldman, J. I., Kuang, W., Conrad, J., Tu, A., Santapuram, P., Simon, D., ... & **Woynaroski, T.** (2018). Brief report: Differences in multisensory integration covary with sensory responsiveness in children with and without autism spectrum disorder. *Journal of Autism and Developmental Disorders*, 1-7.

5. Explored the neural bases and developmental sequelae of early sensory differences in infants at-risk for autism spectrum disorder (ASD).

Sensory differences are now recognized as “core characteristics” of autism spectrum disorder. It has been proposed that early sensory differences may arise from atypical neural function and produce cascading effects on development across a number of domains. In a series of studies, we have prospectively followed infants at heightened risk for autism spectrum disorder (ASD) based on their status as younger siblings of children diagnosed with ASD and infants at relatively lower risk for ASD (siblings of typically developing children) to examine the developmental sequelae and possible neurophysiological substrates of early sensory features associated with ASD. Findings suggest that (a) early-emerging sensory differences are useful for predicting future ASD symptomatology and (b) differences in brain states (oscillatory power, connectivity, complexity, and hemispheric asymmetry) may underlie atypical patterns of sensory responsiveness in infants at heightened risk for autism.

- **Woynaroski, T.***, Damiano, C.*, Simon, D., Ibanez, L., Murias, M., Wallace, M.T., Stone, W.L., & **Cascio, C.** (2017, in press). Developmental sequelae and neurophysiological substrates of sensory seeking in infants at heightened risk for autism spectrum disorder. *Developmental Cognitive Neuroscience*. doi: 10.1016/j.dcn.2017.08.005. *Authors made equal contributions
- **Woynaroski, T.***, **Baranek, G.***, Nowell, S., Turner Brown, L., DuBay, M., Crais, E., & **Watson, L.** (2017, in press). Cascading effects of attention disengagement and sensory seeking on social symptoms in a community sample of infants at-risk for a future diagnosis of autism spectrum disorder.

Developmental Cognitive Neuroscience. doi: 10.1016/j.dcn.2017.08.006. *Authors made equal contributions

- Simon, D., Damiano, C., **Woynaroski, T.**, Ibanez, L., Murias, M., Wallace, M.T., Stone, W.L., & **Cascio, C.** (2017). Neural correlates of sensory hyposensitiveness in toddlers at high risk for autism spectrum disorder. *Journal of Autism and Developmental Disabilities*. doi: 10.1007/s10803-017-3191-4.

Total Number of Peer-Reviewed Publications: 24 published, 2 under review, 5 in preparation

Total Number of Chapters: 2

Total Peer Reviewed Presentations at Scientific Meetings: 74

Citations: 563

h-index: 10

i10-index: 10

For further information, see: <http://scholar.google.com/citations?user=6e8jeJoAAAAJ&hl=en&oi=ao>

D. Current Research Support

1R21DC016144 [PI: Woynaroski]

4/01/2017 - 3/31/2020

NIH/NIDCD

Sensory Project in Infant/Toddler Siblings of Children with Autism (Project SPIS)

It has been proposed that early differences in sensory responsiveness may arise from atypical brain states and produce “cascading effects” on social communication and language ability. The Sensory Project in Infant/Toddler Siblings of Children with Autism (Project SPIS) represents a preliminary test of the “cascading effects” framework in infant and toddler siblings of children with autism spectrum disorder (ASD), who are at high (twenty-fold) risk for a future diagnosis of ASD as well as other language and communication disorders. This innovative and interdisciplinary project may facilitate earlier identification of social communication and language impairments and point towards novel targets of “preventative” interventions, thereby improving long-term outcomes of children who are diagnosed with, or at risk for, ASD.

CTSA Clinical Research Mentored KL2 [PI: Woynaroski]

10/01/15 – 9/30/18

NIH/CTSA

Temporal Facilitation of Audiovisual Speech Processing & Language in Kindergarteners with ASD (TALK ASD) Children with ASD are highly heterogeneous, especially in terms of their ability to use language to communicate. This federally-funded KL2 award is intended to promote Dr. Woynaroski’s development of an independent, translational line of research (a) identifying brain and behavior factors that explain individual differences in language ability and (b) testing whether such factors are plastic and thus potentially treatable in young children with ASD. The TALK ASD project specifically aims to examine whether EEG/ERP metrics of multisensory processing map onto spoken language ability in kindergarten-aged children with ASD.

U54 HD83211-02 [PI: Dykens]

5/01/16 - 5/01/21

NIH/NICHD

Sensory and Multisensory Contributions to Autism

Recent changes to diagnostic criteria recognize sensory differences as “core characteristics” of ASD. This research project aims to a) characterize alterations in sensory and multisensory function and the associated brain networks that contribute to the social communication deficits in ASD; b) explore associations between (multi)sensory function and social and communication abilities; c) describe the differences in the neural processes and networks subserving sensory and multisensory function in ASD, with a focus on a key multisensory ‘hub’ in temporal cortex, and d) develop novel remediation tools in children and young adults with ASD ages 5-21.

1R01DC01376-01 [PI: Yoder]

9/01/14-8/31/19

NIH/NIDCD

Efficacy of Parent-Implemented Treatment in Infant Siblings of Children with ASD

This project is examining the efficacy of an inexpensive home-based early intervention for children at risk for autism spectrum disorders (ASD) focused on early communicative development; this early cost-effective program is part of an Incremental Treatment Approach that proposes to identify which at-risk children would versus would not need more intensive treatment.

Role: Key Personnel