Curriculum Vitae

Nandini Chatterjee Singh

Nationality	Indian
Current Position	Senior National Project Officer (on deputation) UNESCO-MGIEP
Address	UNESCO-Mahatma Gandhi Institute of Education for Peace and Sustainable Development, 35, Ferozshah Road, New Delhi – 110 001, India
Permanent position:	Professor, National Brain Research Centre, NH-8, Manesar – 122051, India
Phone	+91 11 2307 2356-60 (Ext. 115)
Mail	n.chatterjee@unesco.org; nandini@nbrc.ac.in

Research Interests

- Socio-emotional learning
- Reading and dyslexia in biscriptal populations
- Music and speech processing in autism

Academic Employment

10/15 – :	Professor, National Brain Research Centre, India
10/10 – present:	Additional Professor, National Brain Research Centre, India
10/07- 10/10:	Associate Professor, National Brain Research Centre, India
10/02-10/07:	Assistant Professor, National Brain Research Centre, India
08/00-09/02:	Post Doctoral Fellow, University of California, Berkeley, CA,
11/98-07/00:	Post Doctoral Fellow, Ohio University, Athens, OH, USA

Academic Education

1992-1997	Ph.D (Physics), Synchronization in coupled sine-circle maps, University of Pune, Pune, India
1989-1991	M-Sc (Physics), Nagpur University, Nagpur, India
1986-1989	Physics, Mathematics, Electronics, Nagpur University, Nagpur, India

Other Positions

2007 -2009	Associate Editor, Annals of Neuroscience, India.

Honors and Awards

1992 - 1997	Research Fellowship of the Council for Scientific and Industrial Research, India (NET)
2003	Indian National Science Academy travel award.
2009	SSSR travel Award
2010	IMFAR travel Award
2012	BBS Associate
2013	National Young Women Scientist Award
2017	Millenium Alliance Innovation Award (DALI – Dyslexia Assessment for Languages of India)
2018	Reliance-NASI Platinum Jubilee Prize for Application Oriented Innovations covering physical and biological sciences.

Membership of professional bodies, societies, academics

- Brain and Behavioural Sciences
- Society for Neuroscience
- American Physical Society
- Acoustical Society of America
- Institution of Electrical and Electronics Engineers
- Indian Association of Neuroscience
- Indian Academy of Sciences
- Association for Cognitive Science
- Member, National Academy of Sciences India

Selected peer-reviewed publications (in chronological order)

- Perceived Closeness and Autistic Traits Modulate Interpersonal Vocal Communication. Sumathi T. A., O. Spinola., N Chatterjee Singh, B. Chakrabarti (2020). Frontiers in Psychiatry, 11, 50. https://doi.org/10.3389/fpsyt.2020.00050

- Cultural Differences in the Use of Acoustic Cues for Musical Emotion Experience. Midya V., Valla J., Balasubramanian H., Mathur A. and Singh N. C. (2019). PLoS One, 14(9), e0222380.

- Wired for Musical Rhythm? A Diffusion MRI-Based Study of Individual Differences in Music Perception, Rajan A., Valla J. M., Alappatt J. A., Sharda M., Shah A., Ingalhalikar M. and Singh N. C. (2019).. Brain Struct Funct, 224(5), 1711-1722.

- The Role of Phonological Processing and Oral Language in the Acquisition of Reading Skills in Devanagari, N.C. Singh and T.A. Sumathi, Literacy Studies (Book Chapter) (in Press). Handbook of Literacy in Akshara Orthography. (2019).

- Ancestral variations of the PCDHG gene cluster predispose to dyslexia in a multiplex family,T. Naskar, M. Faruq, P. Banerjee, M. Khan, R. Midha, R. Kumari, S. Devasenapathy, B. Prajapati, S. Sengupta, D. Jain, M. Mukerji, **N. C. Singh**, and S. Sinha, EBioMedicine (2018) https://doi.org/10.1016/j.ebiom.2017.12.031

- Music and Emotion - a case for North Indian Classical Music Valla, Valla, A. Mathur, A., J. A. Alappatt, and **N. C. Singh**, Focused review, Frontiers in psychology, 8, 2117- 2127, 2017.

- Reading Research and Practice: Indian Perspective, R. Malatesha Joshi, Pooja R. Nakamura and **Nandini C Singh**, New Directions for Child and Adolescent Development, Vol. 158., 2017. | DOI: 10.1002/cad.20222

- Microstructural anatomical differences between bilinguals and monolinguals, **Nandini C Singh**, A. Rajan, A. Malagi, K. Ramanujam, M. Canini, P.A. Della Rosa and J. Abutalebi, Bilingualism: Language and Cognition, 1-14, 2017. https://doi.org/10.1017/S1366728917000438

- A role for putamen in phonological processing in children, Sarika Cherodath, Chaitra Rao, T. Sumathi, Rashi Midha and **Nandini C Singh,** Bilingualism: Language and Cognition, 2016.

- Reading skills in children provided simultaneous instruction in two distinct writing systems - Insights from behaviour and neuroimaging, **Nandini C Singh**, S. Cherodath, T. A. Sumathi, R. Kosera, K. Currawala, B. Kar, G. Oberoi, Multilingualism, Literacy and Dyslexia: Breaking Down Barriers for Educators (2016): (Book chapter)

- Educational Neuroscience: Challenges and Opportunities, P.N.Tandon, **Nandini C Singh**, Annals of Neurosciences, Vol. 23, No. 2, 2016

- The effect of sung speech on socio-communicative responsiveness in children with autism spectrum disorders, Arkoprovo Paul, Megha Sharda, Soumini Menon, Iti Arora, Nayantara Kansal, Kavita Arora and **Nandini C. Singh**, Front. Hum. Neurosci., 29 October (2015). http://dx.doi.org/10.3389/fnhum.2015.00555.

- The influence of orthographic depth on reading networks in simultaneous biliterate children, Sarika Cherodath and **Nandini C Singh**, Brain and Language, 143, 42-51, (2015).

- Visuo-spatial complexity modulates reading in the brain, Chaitra Rao and **Nandini C Singh**, Brain and Language, 141, 50-61, (2015).

- Structural Covariance Networks in Autism are modulated by verbal ability, Megha Sharda, Budhachandra Khudrapakam, Alan Evans and **Nandini C Singh,** Brain, Structure and Function, Brain, Structure and Function, Volume 221 (2), pp 1017–1032, 2015. DOI 10.1007/s00429-014-0953-z,.

- Fronto-temporal connectivity is preserved in sung but not spoken word processing across the autism spectrum, Megha Sharda, Rashi Midha, Supriya Malik, Shaneel Mukherji and **Nandini C Singh**, Autism Research, doi: 10.1002/aur.14372014, (2014).

- Reading in Devanagari: Insights from functional neuroimaging, **Nandini C. Singh** and Chaitra Rao, Indian Journal of Radiology and Imaging, 24(1), 44 – 50 (2014).

- Notational usage modulates attention networks in binumerates, Atesh Koul, Vaibhav Tyagi and **Nandini C. Singh**, Frontiers in Human Neuroscience, Vol. 8, (2014)

- Are you a good mimic? Neuro-acoustic signatures for speech imitation ability Susanne Maria Reiterer, Xiaochen Hu, T. A. Sumathi, **Nandini C. Singh**, Front. In Cog. Science, doi: 10.3389/fpsyg.2013.00782, (2013) (in press).

- A novel method for assessing the development of speech motor function

in toddlers with autism spectrum disorders, Katherine Sullivan, Megha Sharda, Jessica Greenson, Geraldine Dawson and **Nandini C Singh**, Front. Integr. Neurosci. 7:17. doi:10.3389/fnint.2013.00017.

- 'Cost in Transliteration' – The Neurocognitive Processing of Romanized Writing, Chaitra Rao, Avantika Mathur and **Nandini C Singh** , Brain and Language 124, 205-212, (2013) .
- Effect of Music Instruction on Cognitive Development: A Review, Arkoprovo Paul, Megha Sharda and **Nandini C. Singh**, Journal of the Indian Institute of Science, 92, 441-445 (2013).
- The case of the neglected alphasyllabary – orthographic processing in Devanagari, C. Rao and **Nandini C. Singh** Peer Commentary in Brain and Behavioral Sciences, Volume 35, 5, 302-303, (2012).
- The developing biliterate brain , **Nandini C. Singh**, ISSBD Bulletin 1(61), 22 - 26 (2012).
- Picture-naming in patients with left frontal lobe tumor – a functional neuroimaging study, A. Chakraborty& T. A. Sumathi& V. S. Mehta & **Nandini C. Singh**, Brain Imaging and Behaviour, 6(3), 462-471 (2012)
- Auditory perception of natural sound categories - An fMRI study, Megha Sharda and **Nandini Chatterjee Singh**, Neuroscience, 214, 49-48, (2012).
- Measuring the 'complexity' of sound, **Nandini Chatterjee Singh**, Pramana, Journal of Physics, 11, 5, 811-816 (2011).
- Neuroimaging reveals dual routes to reading in simultaneous proficient readers of two orthographies., T. Das, P. Padakannaya, K. R. Pugh, **Nandini C. Singh**, Neuroimage, 54(2):1476-87 (2011).
- Cortical network for reading linear words in an alphasyllabary, T. Das, R. S. Bapi, P. Padakannaya, and **Nandini C Singh**, Reading and Writing, 24:697–707 (2011).
- Sounds of melody – pitch patterns of speech in autism, M. Sharada, T. Padma, S. Sahay, C. Nagaraja, L. Singh, R. Mishra, A. Sen, N. Singhal, D Erickson, and **N. C. Singh**, Neuroscience Letters, 478(1):42-5 (2010).
- Reading different orthographies: An fMRI study of phrase reading in Hindi-English bilinguals, U. Kumar, T. Das, R. S. Bapi, P. Padakannaya, R. M. Joshi and **Nandini C Singh**, Reading and Writing, 23 (239-255) 2010.
- Categorisation of environmental sounds, R. Reddy, V. Ramachandra, N. Kumar and **Nandini C Singh**, Biological Cybernetics 100(4), 299-306 (2009).
- Neural representation of an alphasyllabary – the story of Devanagari, T. Das, U. Kumar, R. S. Bapi, P. Padakannaya, and **Nandini C Singh**, Current Science, 97(7), 1033-1039, 2009 (Cover illustration).
- Dyslexia, orthography, and brain, P. Padakannaya, N.B. Ramachandra and **Nandini Chatterjee Singh**, Current Science, 1381 (2008).

- The development of articulatory signatures in children, L. Singh, and **N. C. Singh**, (2008) *Developmental Science,* Vol. 11 (4), 467-473*, (2008)*

- Speech rhythms in children learning two languages, Padma, T., T. Das and **N. C. Singh** *Complex dynamics in Physiological Systems - from Heart to Brain*, Springer (2008).

- Das, T., Singh, L. Singh and Singh, N.C. (2007) Rhythmic structures of English and Hindi - new insights from a computational analysis, *Prog. In Brain Res*., Vol.168, 207-72.

- Singh, L., Shantisudha, P., and Singh, N.C (2007) Developmental patterns of speech production in children, Latika Singh and Nandini C Singh, Journal of Applied Accoustics, 68, 260-268.

- Singh N.C. and Theunissen, F.E. (2003) Modulation spectra of natural sounds, *Journal of Acoustical Society of America*, 114 (6), 3394-3411, (2003).

- Grace, J. A., Amin, N., Singh, N. C., Theunissen, F.E. (2003) Selectivity of conspecific song in the avian auditory forebrain, *J. Neurophysiology* 89: 472-487.

- Pradhan, G., Chatterjee, N. and Gupte, N. (2002) Mode locking of spatiotemporally periodic orbits in coupled sine circle maps lattices , Phys. Rev. E, 65, 46227-46230.

- Theunissen, F.E., David, S., Singh, N.C., Hsu, A., Vinje, B. and Gallant, J. (2002) Estimating spatio-temporal receptive fields of auditory and visual neurons from their responses to natural stimuli, , *Network : Computation in Neural Systems*, 12, 289-316.

- Chatterjee, N., and Gupte, N. (2001) Analysis of spatiotemporally periodic behavior in lattices of coupled monotonic maps, *Phys. Rev. E*, 63, 17202-17204.

- Loecher, M., Chatterjee, N., Marchesoni, F., Ditto, W., and Hunt, E. (2000) Noise sustained propagation: local noise vs. global noise, *Phys. Rev. E*. 61, 4954-4961.

- Chatterjee, N. and Gupte, N., (1996) Synchronization in Coupled Sine Circle Maps, Nandini Chatterjee and Neelima Gupte, *Phys. Rev. E* 34, 4457-4466.

- Chatterjee, N. and Gupte, N. (1996) Synchronicity in Coupled Sine Circle Maps: Some Numerical Results, *Physica A* 224, 422-432.

Book – Dyslexia Assessment for Languages of India, **Nandini C Singh** (2015)

Book Editor

• Proceedings of the Indo-US Workshop on Developmental Neuroscience and Imaging, 2008.

• Proceedings of the International Conference of Theoretical Neurobiology, NBRC, December 2003.

Contributions to Education

Since January 2017 at MGIEP, I have expanded my experience to undertake new responsibilities to influence learning and education. Specifically, I have supervised three projects, two designed to introduce socio-emotional learning in education and a third on inclusive classrooms across the world.

I have supervised the design of a unique integrative curriculum entitled Libre that will explicitly build socio-emotional learning in middle school children and will be implemented across 10 countries via a digital learning system. DICE, which stands for Digital InterCultural Exchange uses 'dialogue' as pedagogy in the classroom and has successfully been implemented across schools in 5 countries.

The Difference Learning program at MGIEPis focused on building inclusion in schools. It is an effort to directly translate my research on dyslexia assessment in the mother tongue in different countries across the world. My work in DALI (Dyslexia Assessment in Languages of India) described below is now being scaled to teachers and psychologists. Over the past year, this program provided hands-on training to nearly 500 teachers and 100 psychologists on screening and assessing children with dyslexia in different Indian languages. Recently these tools have been implemented on 28000 children in Delhi Government schools. Additionally I am also building games to augment redaing instruction in the classroom.

Contributions to Science and Policy

My laboratory at the National Brain Research Centre is the first and only one of its kind in India. It uses a combination of behavior, signal processing and functional neuroimaging techniques to study how language, literacy and music are processed by the brain with a particular focus on literacy.

Reading and Dyslexia - India has two official languages namely Hindi and English, which has resulted in a unique biliterate education environment. Hindi and English belong to distinct writing systems. Hindi written in the Devanagari script has an almost unique letter-to-sound mapping; while English written in Roman script has an opaque orthography with one letter representing many sounds (eg, c/ough/, b/ough/). Our work with children and adults has shown important consequences of these differences in script and sound-letter mapping (also called orthography of orthography) on reading circuits in the brain. Our results have not only highlighted the neuroplasticity of the human brain, it has also brought to fore, significant consequences for dyslexia, a learning disability due to which children face serious difficulties in acquiring reading and writing skills as conventionally taught in a classroom.

The assessment of Dyslexia is carried out using a series of age appropriate, culturally valid psychological tests in the native language. Two primary reasons why dyslexia remains undiagnosed in India are:

(a) Lack of sufficient awareness amongst school teachers and parents. (b) Absence of appropriate standardized screening and assessment tools in Indian languages. I was responsible for developing the first set of standardized tools (DALI) for assessing biliterate children in Indian Languages. DALI (Dyslexia Assessment for Languages of India) is a package comprising of Screening Tools for Dyslexia schoolteachers and Assessments for Languages of India (in this case 4 languages Hindi, Marathi, Kannada and English). For the first time, India will have indigenously developed screening and assessment tools that have been standardized and validated across a large population of nearly 4840 children.

Autism - We are the first laboratory in India to study communication in children with autism spectrum disorder (ASD). Central to this has been the finding that speech and stimuli, both auditory stimuli with communicative intent are processed very differently by children with ASD. For instance, spectral analysis of speech from children with autism has shown the presence of distinct prosodic contours that have large variations in pitch that suggest sensitivity to pitch processing by children with ASD. A follow up neuroimaging study of spoken and sung speech in children with ASD showed that networks for sung speech are preserved in whereas those for normal speech were abnormal. The translation of this finding at the clinical level wherein young children between 2-3 years of age showed improvements in socio-communicative intent has provided novel insights on how sung speech may be beneficial in instructing children with autism. This project proposal will benefit from these research findings, in addition to my experience of working with children with autism and their caregivers. In particular, I am excited by the prospect that early spectral analysis of infant babblings and speech along with language milestones and early measures of social cognition might provide early screening for children at risk for autism spectrum disorder.

Music - In Indian classical music, ragas constitute specific combinations of tonic intervals potentially capable of evoking distinct emotions. A raga composition is typically presented in two modes, namely, alaap and gat. Alaap is the note by note delineation of a raga bound by a slow tempo, but not bound by a rhythmic cycle. Gat on the other hand is rendered at a faster tempo and follows a rhythmic cycle. There has been scientific investigations of the emotions underlying different ragas and our primary objective was to study if ragas elicit different emotions and the neural pathways underlying such emotion processing. Further we wish to investigate the association of tonic intervals, tempo and rhythmic regularity with emotional response. Our research so far has revealed ragas elicit distinct emotions and specific tonic intervals are robust predictors of emotional response. Specifically, our results showed that the ‘minor second’ is a direct predictor of negative valence. We are currently investigating the neural pathways underlying such emotion processing.