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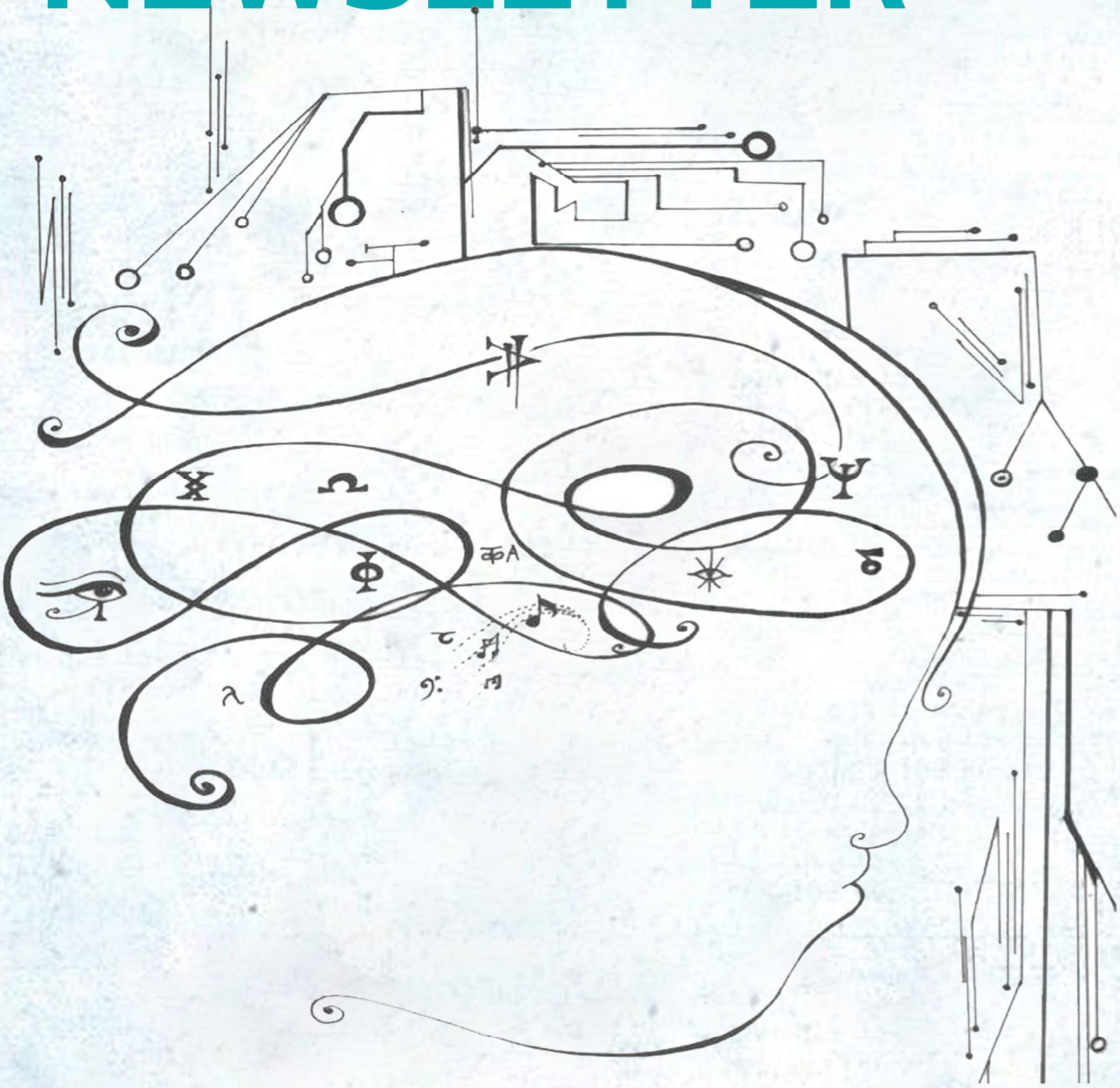
CBCS NEWSLETTER



UNIVERSITY OF ALLAHABAD

ABOUT CBCS

Prof. Bhoomika R. Kar
Head, CBCS

The Centre of Behavioural and Cognitive Sciences has led the development of the discipline of Cognitive Science in India. Over the years we find that the students applying to Cognitive Science programs are more prepared and aware of the nature, scope and challenges of the discipline. It's interesting to observe the shift in the student's mindset and interest in interdisciplinary education and research and more so towards the applications of cognitive science in the field of education, consumer behaviour or health. The fact that students from engineering or medicine or economics are also able to pursue their future career in Cognitive Science is encouraging. Inspired by this progressive change, we have launched the Integrated MSc-PhD program in Cognitive Science at CBCS this year with the first batch of students from different backgrounds including computer science, engineering, medicine, psychology and life sciences.

The Integrated program aims to encourage Cognitive Science Research (both fundamental research and applications in cognitive science). Students in the MSc and Integrated MSc-PhD program are admitted through COGJET and/or GATE score and Interview. This program has been designed in compliance with the objectives of the National Education Policy 2020 including foundational courses in foreign languages (taught by the faculty in the Dept of English and European languages). The integrated program will provide a dual degree, MSc degree in 2 years and PhD degree if one continues after the masters. The regular MSc and PhD programs will continue as the Centre is globally recognized for its Masters' program running successfully for the past 20+ years. Focus of all the academic programs is on hands on training with research skills including psychophysics- based experimentation using Psychopy or E prime and methodologies like eye tracking, EEG/ERP and functional MRI. With the addition of three new faculty members and their expertise, some new electives were added this year and/or offered in the Masters' program such as Time perception, Neuroscience of memory, Brain imaging, Consumer neuroscience and Neuroscience of brain disorders.

The Centre has been conducting a series of National workshops on methods in cognitive science also this year with one on Cognitive neuroimaging: Experimental design and analysis for young faculty, senior PhD scholars and postdoctoral fellows during March 16-19, 2023 after 3 successful workshops held in 2022 on Diffusion Weighted Imaging (June 8-9, 2022), EEG/ERP analysis (Oct 20-21, 2022) and Graph-based network analysis of resting state fMRI data (November 17-18, 2022).

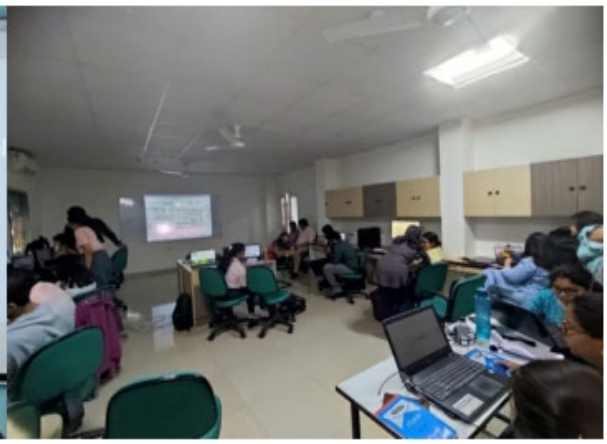
The current research projects at CBCS cover a wide range of new areas such as neuroaesthetics (dance movements and emotions, music perception, dramatic role playing and mentalizing), consumer behaviour, affective computing, social-emotional development, obesity and

cognition, code switching and pragmatics, concept learning, time perception, attention, cognitive control, bilingualism, emotion-motivation and literacy and cognition, effect of green spaces on long term memory, and decision-making using fMRI, eye tracking and EEG/ERP. Students have also been organizing a Journal club on alternate Saturdays and have started a photography/art club, which has further enriched the academic-creative environment at CBCS.

We are progressing to build collaborations nationally and internationally to work on areas of research relevant in Indian context that may generate knowledge of global relevance such as literacy, nutrition, socio-economic status and its effect on cognition and neuroplasticity; clinical neuroscience research on cognitive-affective aging, neurocognitive degeneration; developmental and educational neuroscience research including game based intervention programs for social-emotional development; and research with relevance for industry applications and consumer behaviour and we strive to contribute mindfully and meaningfully to cognitive science research.

EVENTS

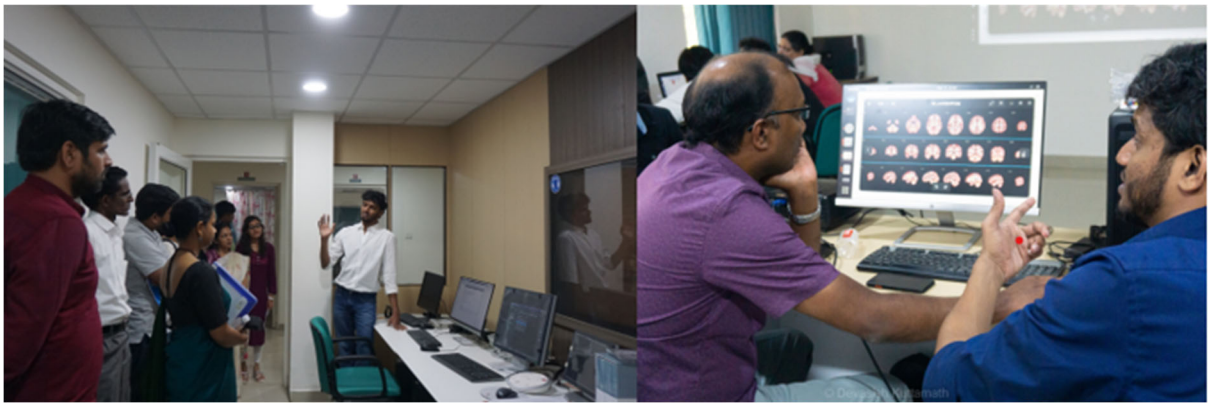
WORKSHOP ON GRAPH-BASED NETWORK ANALYSIS OF RESTING STATE FUNCTIONAL MRI



The Centre of Behavioural and Cognitive Sciences (CBCS), University of Allahabad organised a two-day workshop on Graph-Based Network Analysis of Resting State (brain state in the absence of a stimulus or task) functional MRI starting on November 17, 2022. This workshop was targeted at advanced Masters, PhD and postdoctoral level scholars from Cognitive Science/Neuroscience/Psychology. Twenty scholars from institutions like IIT Kanpur, IIIT Allahabad and CBCS, UoA participated in the workshop. Graph theory can be applied to the resting state fMRI (rs-fMRI) to visualise the brain as a network. The workshop started with an introductory talk on Resting State fMRI and Graph Theory by Dr. Shivangi Jain followed by sessions on Data Acquisition on an fMRI scanner at the National Neuroimaging Facility of the Center by Dr. Amrendra Singh and PhD Scholar Sanchita Mohindru. The goal of this 2-day workshop was to provide hands-on training with the acquisition of Resting-state fMRI data, data pre-processing and analysis.

The focus of this workshop was on the use of Graph Theory Analysis on Resting State fMRI as a tool to address research questions in Cognitive Science/Network neuroscience. Participants learnt to make a brain graph utilising rsfMRI data, compute measures such as modularity, connectivity strength and system segregation and visualise the results on a template brain. Dr. Shivangi Jain, an alumnus of CBCS, currently a Postdoctoral research scholar at the Psychological and Brain Sciences lab at the University of Iowa was the resource person for the workshop with her experience and expertise in fMRI and Graph Theory Network Analysis on the Resting brain. She uses neuroscientific methods such as functional and structural brain connectivity, for her research on Aging and working memory and the effect of cognitive training on neuroplasticity. The hands-on sessions on preprocessing and analysis with a data set were conducted in the lab at the National Neuroimaging Facility, CBCS, UoA. The second day of the workshop focused on Building brain connectivity matrices, Compute graph theory measures and Visualization of modules on a template brain. We believe that workshops on advanced techniques like Graph Theory Network Analysis on Resting state fMRI will certainly aid in training and capacity building for Network Cognitive Neuroscience research in India.

WORKSHOP ON COGNITIVE NEUROIMAGING: EXPERIMENTAL DESIGN AND ANALYSIS

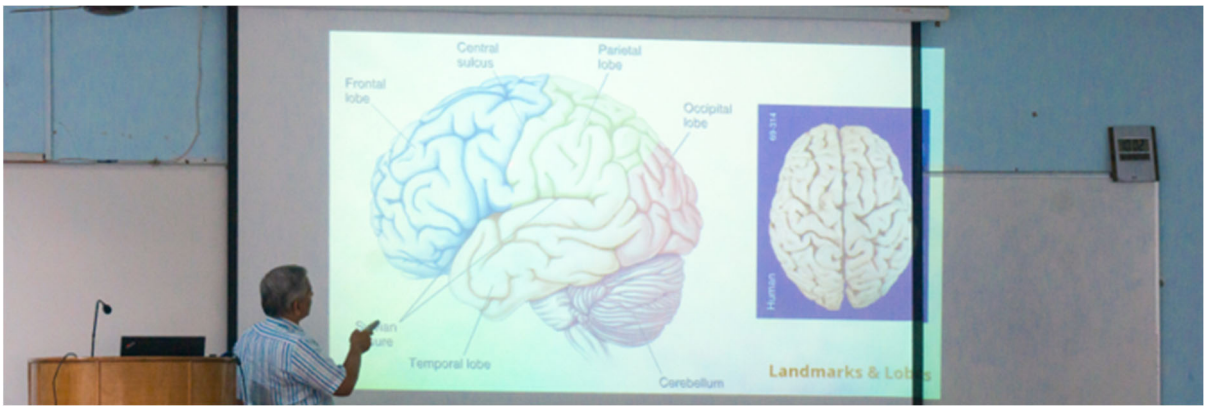


The Centre of Behavioural and Cognitive Sciences (CBCS), University of Allahabad Conducted a four-day Workshop on Cognitive Neuroimaging: Experimental Design and Analysis on March 16-19, 2022 with intensive training in data acquisition, design and analysis using functional MRI. Prof. Bapi Raju, IIIT Hyderabad and Dr Srikanth Padmala, Centre for Neuroscience, Indian Institute of Science-Bangalore and Mr. Sahithyan S, Project Associate, Centre for Neuroscience, Indian Institute of Science, Bangalore were the resource persons for the workshop. A total of 9 faculty and 12 senior doctoral and Postdoctoral scholars from various institutions like IIT Roorkee, IIT Kanpur, IIIT Hyderabad, IIT Madras, IIT BHU, NIMHANS Bangalore, Thapar University, Symbiosis Institute of Operations Management, Dept of Zoology and CBCS, UoA, participated in the workshop.

The workshop provided the participants with a comprehensive and valuable insight into the fMRI Experimental Data Acquisition, Design and Analysis. The sessions included talks on fMRI basics, Design of sample fMRI experiments, data collection procedures, MR safety protocols, Theoretical understanding of how to acquire fMRI data, Practical sessions on Preprocessing of the data, and application of the statistical analysis of the data.

The sessions were conducted at the Centre's National Neuroimaging Facility established in 2019 with a large-scale grant from the Department of Science and Technology, Government of India, dedicated to research and accessible to scholars from institutions across the country. The facility has a 3 Tesla fMRI scanner to conduct neuroimaging research. The outcome of the workshop is that faculty and PhD scholars from IIT BHU, IIT Hyderabad, IIIT Hyderabad, Thapar University and Symbiosis University will access the facility and conduct their research at NNF, CBCS, UoA.

This workshop helped in facilitating potential collaborations on research studies like the effects of ageing and blood glucose levels on brain function, Stroke, Autism, consumer neuroscience of buying-shopping disorders, language compre-



-hension, and Motor-Memory consolidation using TMS and fMRI.

The workshop concluded with networking and collaboration sessions with CBCS faculty, Prof. Bhoomika Kar, Dr. Amrendra Singh, Dr. Shiv K. Sharma and Dr. Jayprakash who discussed the ongoing studies at the National Neuroimaging Facility investigating the effect of various conditions such as ageing, bilingualism, socioeconomic status, literacy, obesity, neuroaesthetics, on brain structure and function. Possibilities of collaborations with cognitive neuroscience expertise at CBCS with Machine learning and computational neuroscience expertise with faculty from technical institutions were also discussed. The Workshop certainly acted as a milestone to improve conceptual and technical skills for cognitive neuroscience research and emphasized the importance of having a National Neuroimaging Facility in a University. The participants appreciated the academic environment and the keen efforts by the faculty and students for conducting such workshops which help in capacity building and upgrade analytical skills for Cognitive Science research in India. This workshop was supported by the DST-funded neuroimaging grant of the Centre.

COMPUTATIONAL ADVANCES IN 3D TRACTOGRAPHY VISUALIZATION FOR NEUROIMAGING

The Centre of Behavioural and Cognitive Sciences (CBCS), University of Allahabad organized a special lecture on 28th June 2023. The session was chaired by Prof. Sangita Srivastava, Honorable Vice Chancellor, University of Allahabad. The session began with a warm welcome of the Vice Chancellor and the Guest speaker by Dr. Niharika Singh and Dr. JayPrakash, Faculty CBCS. This was followed by a brief introduction of the Centre and National Neuroimaging Facility by the Head of the Centre, Prof. Bhoomika R. Kar. Chair of the session, Prof. Sangita Srivastava, in her address emphasized the importance of brain research in India in fields like nutrition, health, ageing, artificial intelligence, clinical applications of MR.

Dr. Amrendra Singh, Faculty CBCS, introduced the Guest Speaker, Dr. Sudhir Pathak, from the Learning Research and Development Centre, University of Pittsburgh, USA. Dr. Pathak's primary research areas are Neuroimaging, Neurocognition and has worked in the domain for over 15 years. Dr. Pathak completed his BS and MSc (Integrated) in Mathematics and Scientific Computing from IIT Kanpur and pursued his PhD in Bioengineering at the University of Pittsburgh in the field of diffusion-weighted MRI.

His research interests include the validation of diffusion models in biological tissues, Biomarkers for Traumatic Brain Injury, Diffusion MRI, Microstructural Imaging, and fibre tractography. Dr. Pathak is well-known in the field for proposing high-definition fibre tractography and has developed many experimental computational methods to assist and guide pre-neurosurgery planning that have been used by surgeons at multiple institutions on an experimental basis. In his talk, Dr. Pathak discussed high-definition fibre tractography with examples from clinical case studies on Traumatic brain injury and Stroke. He also emphasized the need for such innovative research in India and expressed his interest in exploring collaboration with CBCS. The talk also led to a very engaging discussion on brain research, fibre tracking and its clinical applications with some interesting areas of research suggested by Honorable Vice Chancellor Madam, Dr. Pathak and faculty present in the audience.

After the informative talk, Prof. Shiv Sharma, Faculty CBCS, presented a memento to the Chair of the session, Honorable Vice Chancellor and the guest speaker, Dr. Sudhir Pathak. The session ended with a vote of thanks proposed by Dr. Niharika Singh, Faculty CBCS. After the talk faculty and the Honorable Vice Chancellor visited the National Neuroimaging Facility to see a demonstration of an MR scan. The Centre looks forward to more interaction with Dr. Sudhir Pathak for his expertise in the field of neuroimaging.

CHARACTERISATION OF BRAIN NETWORKS USING NEUROIMAGING AND ITS APPLICATIONS

The Centre of Behavioural and Cognitive Sciences (CBCS), University of Allahabad organized a special lecture on 14th July 2023 in the Seminar Hall at CBCS. The session began with a warm welcome of the Guest speaker, Prof. Gopikrishna Deshpande, Department of Electrical and Computer Engineering, Auburn University, USA by Prof. Bhoomika R Kar, Head CBCS. Prof. Kar introduced the guest speaker and mentioned about the ongoing collaborative study with Prof. Deshpande on the effect of solar eclipse on brain function.

Prof. Gopikrishna Deshpande did his MS in Electrical Communication Engineering, at IISc Bangalore. He pursued his PhD in Biomedical Engineering from Georgia Institute of Technology, Atlanta, USA. He has been a faculty at Auburn University for more than 10 years and heads the neuroimaging activities at the Auburn University MRI Research Centre. Prof. Deshpande has expertise in methods like signal and image processing, fMRI, multimodal imaging, network modelling, and deep learning. His work has applications in Neuroeconomics and Neuromarketing, Meditation, cognitive, and social-affective neuroscience.

In his talk, Prof. Deshpande gave a brief primer on characterizing directional brain networks using fMRI and showcased both clinical and basic science applications. First, he illustrated how such a characterization can help us understand brain network alterations in mild cognitive impairment and Alzheimer's disease. Next, he discussed applications of this methodology in neuroeconomics for understanding neural correlates of consumer behavior. Toward the end, the talk led to an engaging discussion on the technicalities of the methods he discussed and the applications of his work. After the informative talk, Prof. Shiv Sharma, Faculty CBCS, presented a memento to Prof. Deshpande. This was followed by a stimulating discussion between Prof. Deshpande and the doctoral and MSc students of CBCS present in the audience. Faculty, CBCS also had a more detailed discussion with Prof. Deshpande about the current neuroimaging projects and possibilities for a potential collaboration.

OUTREACH ACTIVITY

ALLAHABAD REGIONAL BRAIN BEE (NEUROSCIENCE QUIZ)

Allahabad Regional Brain Bee (ARBB), a neuroscience contest for 11th-grade students, was hosted by the Centre of Behavioural and Cognitive Sciences, University of Allahabad, on February 11th, 2023. Brain Bee contest is an attempt to motivate students to learn about the brain, capture their imaginations, and inspire them to pursue careers in biomedical brain research. It is a non-profit neuroscience competition for high school students that provides an opportunity to participate in an international conference on neuroscience. 22 students from 11 prestigious schools in Allahabad participated in the competition.

Each participant was accompanied by a guardian – a teacher or a parent. The competition consisted of a written round followed by three phases of oral rounds, with increasing levels of difficulty. The judges for 2023 ARBB were Prof. Shiv Kumar Sharma, Centre of Behavioural and Cognitive Sciences, University of Allahabad and Prof. K.P Singh, Department of Zoology, University of Allahabad with their expertise in the field of neuroscience research.

The technical team for ARBB included MSc final-year students with Hurshitha Vasudevan as the quiz Master. The event was organised by the faculty and students of CBCS. Prof. Bhoomika R. Kar, coordinator, of ARBB, extended a warm welcome during the inaugural session and spoke about the rapid emergence of the brain sciences as a major area of research. She encouraged students to consider the brain sciences as a promising career by introducing the work (courses and research) being done in CBCS.

The 2023 Allahabad Brain Bee winner is Ujjwal Srivastava from Boys High School, Allahabad. The first runner-up is Aariz Khan from Boys High School, Allahabad and the second runner-up is Aditya Upadhyay from St. Joseph College. Prof. K P Singh and Prof. Shiv Kumar Sharma felicitated the winners with a trophy, certificate and a book on neuroscience and presented certificates of participation to all the participants. Prof Bhoomika R. Kar presented the certificates of appreciation to the teachers and presented the judges with mementoes as a token of appreciation. The Brain Bee champion 2023 will be invited to participate in the National Brain Bee finals to be held in New Delhi in April 2023. This event has established a platform to foster neuroscience at the school and college level in the city of Allahabad.

CBCS 22ND FOUNDATION DAY

FOUNDATION DAY - 2023

The Centre celebrated its 22nd Foundation Day on 3rd November, 2023. Prof. Nandini Chatterjee Singh, Senior National Programme Officer at UNESCO Mahatma Gandhi Institute of Education for Peace and Sustainable Development (MGIEP) delivered a special lecture on "The Rasa in the Raga" after a brief report presented by Prof. Bhoomika R. Kar on the accomplishments and advances which took place in the Centre during the past year.

Prof. Nandini Chatterjee Singh is an eminent professor-researcher whose accolades include teaching and research at the National Brain Research Centre.

She has worked on the cognitive neuroscience of reading, auditory perception, language, music, and developmental disorders such as autism and dyslexia. Her talk revolved around an investigation into how distinct ragas from Hindustani classical music evoke distinct emotions. The behavioural and neuroimaging results discussed showed that listening to different ragas does indeed elicit different reactions, which can generally be divided into positive and plaintive. The study was cross-cultural, and included data from nine countries.

She concluded by emphasising that ragas are a promising paradigm for experimentation in music cognition and emotion. The second speaker, *Mr. Shuborno Chakroborty, is an alumnus of this centre, and now holds the position of director at Inscope Social Foundation, which he co-founded.* His talk was titled "Cognitive Science and Education: A Synergistic Approach Through Science Communication". He holds a Masters in Public Policy from IIT Delhi and specialises in the field of Science Communication. Besides this, he has authored textbooks, published poetry, and worked for several NGOs. His session pertained to the issues prevalent in the education system, and how they could potentially be redressed through the application of Cognitive Science principles. He discussed the topic in a holistic manner, covering a number of factors, including the importance of cultivating creativity and communication, mitigation strategies, cultural contrasts, and the evolving priorities of education as it interacts with industry and government. Both the invited speakers held an interaction session with students and faculty of the centre deliberating upon topics like music cognition, emotion and music, cognitive science and education, science commulication, and social emotional learning.

PLACEMENTS & CONGRATULATIONS

PLACEMENTS - PHD

Sayali Pethe (M.Sc 2021-2023)

Ph.D, RayLab, Ashoka University, Sonipat

Muskan Jindal (M.Sc 2019-2021)

Ph.D, IIT Gandhinagar

Moon Majumdar (M.Sc 2020-2022)

Ph.D., Department of Cognitive Science, IIT Kanpur

Achint Sharma (MSc from CBCS)

Ph.D., Cognitive and information Sciences, University of California, Merced

PLACEMENTS - INDUSTRY

Hiral Kapadia (M.Sc 2021-2023)

Junior Researcher, Bombay Design Centre, Mumbai

Shuborno Chakroborty (M.Sc 2019-2021)

Founder and Director, Inscope Social Foundation

PLACEMENTS – JUNIOR RESEARCH FELLOW

Hurshitha Vasudevan (M.Sc 2021-2023)

Junior Research Fellow, Stress and Cognition Lab, Cognitive Science IIIT Hyderabad

Kriti Das (M.Sc 2021-2023)

Junior Research Fellow, CNCS, University of Hyderabad

PLACEMENTS – RESEARCH ASSISTANTS/PROJECT ASSOCIATES

Arihant Jain (M.Sc 2021-2023)

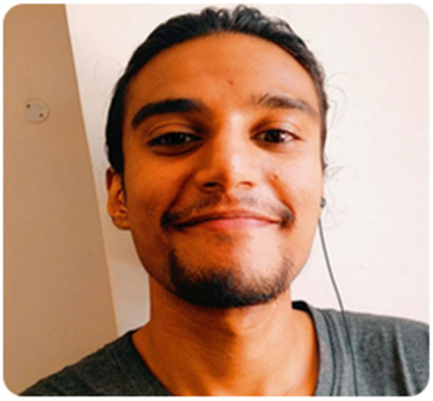
Project Associate-1/JRF, NeuroTech Lab, IIT Hyderabad

Akanksha Pandey(M.Sc 2021-2023)

Project Associate-1/JRF, NeuroTech Lab, IIT Hyderabad

Amruthavalli V V (M.Sc 2021-2023)

Research Assistant, Cognitive Control and Development Lab, CBCS, Prayagraj



Bhaj Gobindh Raj, (M.Sc 2021-2023)

Research Assistant, Noema Foundation for Research in Mind & Brain Sciences/ CNCS, University of Hyderabad

Pranjul Verma, (M.Sc 2021-2023)

Project Associate, Translational Neuroscience and Technology Lab, IIT Kanpur

Ritu Giri, (M.Sc 2021-2023)

Research Assistant, Noema Foundation for Research in Mind & Brain Sciences/ CNCS, University of Hyderabad

Devasish Kuttamath (M.Sc 2021-2023)

Psychology Researcher, Tattva Software Technologies, Bengaluru

Ansh Bharadwaj (M.Sc 2020-2022)

Project Associate, IIT Kanpur

CONGRATULATIONS

Tanya dash (PhD CBCS)

Assistant Professor, Faculty of Rehabilitation Sciences, University of Alberta, Canada

Dhrubjyoti Sarma (PhD CBCS)

Assistant Professor, National Forensic Science University, Gandhinagar

Maruti Mishra (PhD CBCS)

Assistant Professor of Psychology, California State University Bakersfield, California, USA

RESEARCH ARTICLE

AGING - COGNITIVE RESERVE AND RESILIENCE

The dynamic relationship of brain and cognition changes over a lifespan. Ageing is primarily associated with decline in physical and cognitive health, however not all functions deteriorate and few other changes that come with aging are positive. Starting from middle-age, cognitive functions tend to define the quality of life with a recent claim that the determinants of successful aging can be identified from young adulthood (Park, 2019). It's important to note that while cognitive decline is a common feature of aging, it varies from person to person. Some individuals experience minimal cognitive decline, while others may face more significant challenges. In terms of the neurological changes that come with age, they are not uniform across brain structures, cognitive domains or individuals. The cognitive reserve hypothesis states that some individuals have a greater ability to

Sanchita Mohindru
PhD Scholar, CBCS

bear against pathologic changes to the brain, like accumulation of amyloid protein resulting from greater brain reserve (Stern, 2002). This hypothesis posits that higher levels of education, participation in certain activities, higher socioeconomic status, and baseline intelligence protect against the clinical reflection of brain disease (Fotenoz et.al, 2008). Lifestyle factors and genetics play a key role in determining how an individual ages. Additionally, advancements in neuroscience and healthcare have provided new opportunities for interventions and strategies to support cognitive health as people age. Engaging in cognitive retraining and trying to build cognitive reserve are all approaches to achieve successful cognitive aging.

The life-span theory of control posits that individuals' capacity to control their environment and achieve their developmental goals declines in old age (Heckhausen, Wrosch, & Schulz, 2010). Studies have also suggested that rather than using primary control strategies that might change the situation, older adults increasingly use secondary control strategies, such as emotion regulation, which aims at changing the self to better adjust to the situation. Research suggests that *reasonably high levels of affective well-being and emotional stability are evidenced in old age*. The most important finding here is perhaps that affective well-being does not decline during most of the years in the adult lifespan (Isaacowitz and Blanchard-Fields, 2012). With age, people might become more knowledgeable about the emotional effects of certain future events, and indeed become better at tailoring their emotion–regulatory strategy to the contextual demands (Blanchard & Fields, 2007).

Based on the assumption that a limited future time perspective in the elderly promotes a focus on optimizing emotional gratification in the present moment, researchers have begun to examine the consequences of this motivational shift for cognitive processing. It has been found that, mood-enhancement goals render older adults more sensitive to positive information and less sensitive to or ignorant of negative information, a phenomenon termed as the "positivity effect" (Carstensen & Mikels, 2005). A pertinent question in this context is that how do older adults maintain high levels

of affecting well-being after they are confronted with bodily deterioration, increasingly frequent health problems and memory failures, and losses in mobility and in social worlds? One possible explanation, is an increasing motivation to regulate emotional states and increasing competence to do so.

Interestingly, it has been seen that the more cognitive resources older adults have, the better they seem to be able to selectively attend to positive stimuli and avoid negative ones. On the same lines, it has been seen that emotional ageing may serve as a protective factor as long as the cognitive control system is intact. Emotional wellbeing can enhance the control system by building resilience or compensation. Neuroimaging studies suggest that amygdala activity does not decline with age, however amygdala reactivity to negative stimuli declines with age. This downregulation is mediated by control processes implemented by brain regions like Anterior Cingulate Cortex and medial prefrontal cortex (Mather, 2012) suggesting that there is an interaction between the underlying mechanisms of cognitive and affective aging. Research from Western cultures has suggested that emotional well-being improves as individuals get older, but there is mixed evidence of the same in East Asia. Is positivity effect and its interaction with cognition (attention, memory and cognitive control) a universal phenomenon or may vary as a function of socio-cultural context? Studies on emotional wellbeing on eastern population highlights the difference in collectivist society versus individualist (western population) society and its possible influence on emotion regulation motivation with ageing. If emotion regulation motivation shifts towards positive affect with ageing it is likely to have an impact on cognitive wellbeing given the known interactions between affect and cognition.

With growing age and especially after entering into the elderly phase, changes at the cognitive level are small and might not always result in impairment of function but participation in certain activities, can contribute to building resilience and cognitive reserve. In the recent past, aging research has seen an enormous increase in the age-related strategic shift towards emotional goals, where, as age advances, emphasis on emotional life goals increases given the corresponding reduction in life expectancy. This set of strategic adjustments in emotional processing has been argued to depend on the availability of cognitive resources particularly cognitive control (Mather & Knight, 2005). This idea is supported by the fact that cognitive reserve has an impact on the age-related positivity effect in memory. For instance, Bruno et al (2021) found that age was negatively correlated with recall of positive words in participants with fewer years of education. Spontaneous engagement of emotion control regions aids in emotion-regulatory benefits. Connecting brain and behavior, engagement of emotion control regions may result in the reduction in subjective experience of low-arousing negative information among elderly, supporting the idea of activation of emotion regulation in aging. Such age-related changes in affective experience and regulation across the life span are expected to influence cognitive functioning and socio-emotional wellbeing.

Psychological and Cognitive Interventions for Older Adults

Interventions aimed at enriching daily cognitive functioning and promoting everyday competence can have a positive impact on the aging process. Meditation, relaxation techniques adequate rest and quality sleep can help manage stress, promote mental clarity, and contribute to emotional balance.

There is evidence to show that stimulating activities protect against dementia. Frequent engagement in mental and social activities helps in reducing the incidence of dementia. This finding also shows that resilience is not only a 'naturally-occurring' phenomenon, but that, it can be supported and strengthened by individual life styles, and by 'age-friendly' social environment. In addition, physical activity interventions with muscle strength training and aerobic exercise prove to have positive effects on the social and cognitive well-being. These interventions have proven to show an improvement at the brain level particularly in the strength of synaptic connections too (Colcombe et al., 2006).

In case of ageing related cognitive disorders, for instance, training with individuals with Mild cognitive impairment (MCI) using interactive imagery, face-name associations, hierarchical and semantic organization techniques have shown positive effects of training in subjective memory and well-being. Also, a study showed that individuals with MCI were able to recruit new neural circuits to perform the demanding memory tasks compared to healthy older participants who did not receive the intervention (Belleville et al., 2011). In addition, clinical gero-psychologists have contributed to neuro-rehabilitation programmes for older people with cognitive linguistic therapies for deficits related to language after stroke in the left-hemisphere. Interventions for those with traumatic brain injuries resulting in functional communication deficits, training in problem-solving, goal management and self-monitoring strategies for elderly with executive functioning deficits are also a significant contribution.

Ultimately, degradation to death remains an inevitability, but adopting *a holistic approach* that combines physical health, cognitive engagement, emotional regulation, and social connection *can be empowering to older adults*. These protective factors not only contribute to graceful aging but can also have positive effects throughout the lifespan.

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IN CONVERSATION WITH GOPIKRISHNA DESHPANDE

Dr. Gopikrishna Deshpande
Professor (EC & CS), Auburn University

1. Your research interests with details about your current work, which you consider innovative.

I am interested in understanding brain function in health and disease using brain imaging. Given the recent explosion in the quality and quality of data that is obtainable, the most innovative aspects of my research have involved the use of machine learning and artificial intelligence to understand the hidden patterns in data. We have recently shown that this methodology is capable of performing "mind reading", i.e., using the data to decipher what an individual may be seeing, hearing, experiencing or thinking.

2. Methodology that you work with and the challenges associated with it.

I work primarily with functional magnetic resonance imaging. The challenges are primarily because of the interdisciplinary nature of the field. The questions we aim to address arise in basic neuroscience or medicine. Experimental design needs knowledge of psychological sciences. MRI data acquisition is based on physics and electronics. The data analysis relies on signal/image processing, mathematics/statistics and machine learning/data analytics. The ensuing results need to answer the question originally posed in neuroscience or medicine. One can begin to gauge the diversity of expertise needed to be successful in such an endeavour. While one cannot be a master of such diverse subjects, we would still need to understand aspects of all the above fields. It underlies a fundamental philosophy I believe in – we are not here as neuroscientists, engineers or doctors. We are here to solve real-world problems, which tend to be multi-disciplinary in nature. We need to learn and use whatever is necessary to solve the problem. Disciplinary silos that humans have created for themselves are sometimes not useful for understanding complex natural systems such as the human brain

3. Career opportunities, training and prerequisites as a guide for students entering neuroscience/ cognitive science

As I mentioned above, students entering neuroscience and cognitive science need to have a problem-solving-oriented approach. The brain is a complex organ and to understand its workings, one needs to be able to use a diverse set of tools. While traditional career opportunities exist in academia, new opportunities are opening up in the industry. Enterprises with profit-motive are beginning to understand that it is fundamental to understand human behaviour to model the economic system. A new field of neuroeconomics has thus come up. The point is that understanding the human experience and individuality will be central to much of the new-age economy and hence I feel that neuroscientists with a diverse set of tools will have a wide range of career opportunities in the industry in the very near future.

4. Challenges in your field of research, anything that keeps you going, and new technologies related to methodology that you look forward to incorporating (if any).

Much of modern science has dealt with understanding observables in nature. Only recently has it been recognized that observables are dependent on the observer, i.e., humans. In order to

understand the world around us, we first need to understand ourselves (i.e., how our brain works). This new-age understanding is emphasized by global initiatives such as the Brain Initiative in the US and the European Brain Project. Yet, it is paradoxical that we might be re-inventing the wheel here since understanding ourselves to understand the world is eerily similar to the Indian civilizational thought process. Therefore, what keeps me going is this beautiful philosophical synergy between how ancient civilizations (such as India) approached the question of understanding the world through understanding ourselves versus how modern science is gravitating towards that view, albeit through a very different trajectory.

As regards new technologies, we have acquired a new Siemens 7 Tesla MRI scanner called the Terra X. It is FDA-certified for clinical use and the first such scanner anywhere in the world. It is a powerful machine, with capabilities to measure brain function in unprecedented detail – both in space and time. It is my endeavor to use high-fidelity data obtained from this scanner along with artificial intelligence to decode human cognition with greater and more precise detail. I believe the Pink Floyd song recently reconstructed from brain waves (https://bit.ly/musicandbrain1) must even more closely resemble the original.

ALUMNI CORNER

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The Intersection of Cognitive Science and Policy Sciences: Navigating Complexity for Informed Decision-Making with "New Policy Sciences"

In policy-making, the interplay between human cognition and the decision-making process holds profound significance. The synthesis of policy studies with insights from cognitive science has given rise to a new paradigm known as the "new policy sciences." This paradigm recognises the intricate relationship between human cognition, emotions, and the intricacies of policy contexts, revolutionising the way we understand and approach policy analysis.

As we delve into this intriguing fusion of disciplines, we begin to unravel the nuanced connections between policy and cognitive science, illuminating how this collaboration shapes the trajectory of effective governance.

At the heart of this article lies Herbert Simon's analogy of the ant's path. Just as the ant navigates a meandering line to reach its destination, policymakers traverse a complex terrain of options, targets, and uncertainties. Simon's analogy serves as a poignant representation of the multifaceted nature of decision-making. In both cases, choices are made with imperfect information, adaptive strategies, and an essential blend of rationality and emotions. This analogy forms the foundation of the "new policy sciences," offering a unique lens through which to explore the intricate dynamics of policy formulation. **[1]**

Cognitive science sheds light on the role of emotions as critical factors in decision-making. When formulating opinions, policymakers draw upon a complex interplay of emotions, gut feelings, beliefs, and rational analysis. This amalgamation of rational and irrational processes shapes the choices they make, especially in the face of limited information. Thus, policy analysts must recognise the value of emotions as instructive pathways and draft their advice in a manner that emotionally resonates with decision-makers.

Policy-making does not occur within a vacuum. The environment in which decisions are made is a complex web of relationships, institutions, networks, and narratives. This contextual complexity significantly influences the effectiveness of policy advice. While acknowledging the limitations of predicting outcomes, policy analysts must grasp the nuances of the policy context. Long-term engagement, trust-building, and understanding the iterative relationship between individualities and their surroundings emerge as strategies for crafting impactful policy analysis. In essence, effective policy advice becomes contingent on contextual awareness and the ability to adapt within a dynamic landscape.

A cornerstone of the new policy sciences is the recognition of "bounded rationality," wherein policymakers possess limited information and cognitive processing capabilities. This understanding challenges the traditional notion of comprehensive rationality and embraces the reality of decision-making under uncertainty. **[2]** Drawing from cognitive science, policy scholars acknowledge that individuals employ heuristics and cognitive shortcuts to gather sufficient information for "good enough" decisions. In this sense, policy analysts and advisors must tailor their recommendations

to align with the cognitive limitations of policymakers, presenting information in a digestible manner that considers cognitive load.

The traditional dichotomy between "knowledge of" and "knowledge in" the policy process has created a gap between academic research and practical implementation. The new policy sciences advocate for the integration of applied and theoretical knowledge, bridging the divide between theoretical understanding and real-world implications. This convergence calls for policy scholars to base their advice on both theoretical insights and practical understanding, addressing the symbiotic relationship between these two disciplines. Such integration may foster a holistic approach that will equip policymakers with the tools to navigate complex contexts while making informed decisions.

At its core, the new policy sciences emphasise the significance of critical thinking as a compass for decision-makers. Rather than seeking a universally applicable policy process, this paradigm encourages policymakers to engage with diverse perspectives, question assumptions, and adapt strategies to fit the ever-changing policy landscape. Policy scholars, in turn, serve as catalysts for this journey of critical thinking, offering insights that guide individuals through the intricate maze of policy choices.

Aligned with Lasswell's vision of the policy sciences contributing to societal advancement and human well-being, the new policy sciences embrace the concept of policy as a vehicle for positive change. This synthesis transforms policy analysis into a dynamic process that acknowledges the limitations of human cognition while leveraging cognitive shortcuts, emotions, and adaptive strategies. **[3]** By embracing both applied and theoretical knowledge, policy scholars may pave the way for informed decisions that uphold the values of human welfare and political equity.

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Unveiling the Learning Crisis in India: A Cognitive Science Perspective

Can cognitive science help alleviate the learning crisis? Education is wickedly complex. India has four times the number of schools compared to China for nearly the same number of students. Yet, Indian students perform pathetically in international assessments, far behind China. The reasons for this are multi-fold, in this piece, I want to talk about one of the major ones- The problem of learning.

India is facing a learning crisis. For instance, only 50.3 per cent of students in Class 5 can read text meant for Class 2 students. The deficit can be witnessed across government and private schools. Only about 40 per cent of Class 8 students in government schools can do simple division. In private schools the figure, though better than in government schools, is just 54.2 per cent. [1] The three R's of education- Reading, writing and arithmetic form the backbone of basic education. All future learning builds up on these three. Our system appears to be failing even at such a basic level.

Can the science of learning help us turn this tide?

Access alone is not a problem. Poor educational outcomes are also a result of how things are taught. Especially, poor teaching methodologies based on outdated, poorly informed theories of how the human mind learns, and how our memories work.

We can't expect kids to learn by merely ensuring they spend 6 hours a day in the classroom. The academic year moves on, but students fall behind, sometimes far too behind to even fathom catching up. My 6-year-old niece came sobbing from school the other day. "I am too stupid, why can't I understand anything?" She cried about not being able to read words that her classmates easily could. Thankfully her mum is a kindergarten teacher herself and helped her catch up. Most aren't as lucky, and many of those who fall behind, stay behind.

Robust learning requires carefully designed environments and well-informed teachers. Years of pedagogical and learning sciences literature have unequivocally suggested that when learning events are aligned with the forgetting curve of human memory, learning improves. Duolingo elegantly exploits this insight into human memory by fitting forgetting curves for various concepts and presenting the learner an opportunity to re-practice a word right at the point they are about to forget it [2]. Such "spaced practice" reinforces the memory for the word, or any concept for the matter, and is one of the most robust findings in the learning science literature [3][4].

Besides spaced practice, there are many ideas that have stood the test of time, such as interleaving, retrieval practice, chunking etc. However, how many of us really know anything about it? Few teachers are equipped with the knowledge of human learning.

Another under-appreciated aspect of 'learning about learning' is understanding the journey towards deep conceptual understanding. This journey is rarely linear, filled with misconceptions of various shapes and forms. A key to mastery is addressing these misconceptions before it's too late.

For example, which of these is greater? 6.03 or 6.3?

Of course, 6.3, but a sizeable number of students would respond that 6.03 is greater, while some others might say that they are both the same. The first set of students could possibly have String length thinking, they think that 6.03 has more digits so it must be larger. Just like 603 is larger than 63. The second set of students has a misconception called numerator-focused thinking [5]. Here, they think the addition of '0' after decimal makes no difference, just like adding '0' before a number makes no difference in integers (38 is the same as 038). The exact same question, but such radically different ways of thinking. Misconceptions appear across topics, and understanding them is a key to better learning. In a 2013 study**, t**eachers were randomly divided into two groups [6]. One group was taught about various misconceptions, and the other wasn't. Students of the teachers in the misconception group showed higher learning gains at the end of the academic year compared to the students of the teachers in the control group.

One-on-one tutoring often allows a teacher to tailor the content and pace of learning for the student. They can identify an issue and provide more time for practice before moving on. But how do we implement such a thing in classrooms? especially when we have huge classrooms, with learners with a multitude of different abilities. In such situations, we can't even expect a well-informed teacher to attend to each and every student. This is a promise that learning sciences have been trying to deliver for a very long time, and one idea has come pretty close- learner modelling.

Can we predict mastery of concepts?

Learner modelling sits right at the intersection of computational cognitive science and learning experience design. A learner model traces the knowledge acquisition process of a student as they practice various problems in a topic on their way to mastery. Some models even trace the forgetting curves, such as the one used by Duolingo mentioned above.

Learner models, or student models, as some might call them, are at the core of 'Intelligent Tutoring Systems' (ITS) [7]. ITS's combine insights from cognitive science, student modelling and effective curriculum design to deliver high-impact learning experiences. These systems can identify the concepts students are struggling with and provide them with specific problems and feedback.

Learning in ITS is often problem-based in order to encourage active learning & problem-solving. Classroom learning more often than not becomes passive infotainment. ITS try to provide the right problem at the right time, often trying to tread the goldilocks zone where the problem difficulty is neither too hard nor too easy.

The design principles of ITS have made them a highly effective educational intervention. For example, In a 2017 paper, Prof Karthik Murlidharan and the team found that urban students (from lower and middle-income SES groups) who got a lottery to use an ITS (called Mindspark) outperformed their control group in a follow-up post-test after 4.5 months on Hindi (relative gain

of 0.22 SD) and Math (relative gain of 0.36 SD). The relative learning gains were found to be highest for the weakest students. [8]

This crisis can be solved

An understanding of cognitive science affords us a unique insight into learning, and thus into the science and art of designing learning experiences. Be it digital learning or offline learning, the capacity to dive deep into the literature, design theory-backed curricula, experiment with various learning materials and analyse them in a rigorous statistical manner is sorely lacking in the Indian education system. There just aren't enough cognitive scientists working on these problems, especially in India. Besides the many utilitarian arguments one can make, there is something innately human about the act of learning; Something enlightening about the exploration of unfamiliar mindscapes; something serene about living the experiences and ideas of those who inhabit a different space and time. It is this 'something' that makes the pursuit of learning & education an end in itself.

The learning crisis deserves our attention.

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Igniting the Spark: How two years at CBCS are shaping my journey into user research

Looking back, I realize that a tiny spark of my current interests had first twinkled during my bachelor's course. But it was only at the Centre for Behavioral and Cognitive Sciences (CBCS) that this spark ignited into a full-blown passion, powerful enough to shape my career. I believe that everyone who steps into CBCS experiences their own sparks bursting into fireworks.

I pursued my bachelor's in psychology, with economics and commerce as my minors. Until my second year of college, economics felt dry and uninteresting. That all changed when I delved into the works of Kahneman, Sunstein, Thaler, and others. The marriage between economics and psychology was fascinating. During my final year of college, I embarked on a small research project on the concept of "Nudge." However, it was only during my time at CBCS, that I began to deeply ponder upon the influence, assumptions, and fallacies associated with nudging. My journey as an aspiring applied researcher essentially commenced from the day, I sat in the classroom of CBCS.

Over my two years at CBCS, I can genuinely say there was not a single day when I felt my learning and growth stalled. Each course was well designed to provide us with a comprehensive theoretical understanding of cognitive science and research methodology. Moreover, thanks to the diverse research interests of the faculty at the centre, I was able to align my master's thesis topic with my interest in Decision Making which has proved quite relevant to my career thus far. To state it clearly, here are the three key lessons from my time at CBCS that are helping me in user research:

1. **Fundamentals of Research and Critical Thinking**: The research cycles in the industry are short. That means, the time to think and ponder on the questions is limited. Thus, developing critical thinking and intuition about methodology is invaluable at the job. The course, being research-oriented, first and foremost instilled critical thinking. It built the ability to question "why" and delve into the intricacies of a problem. It taught me to be skeptical, which is crucial for my current work, especially when collaborating with designers and growth professionals who may have biases toward their ideas.
2. **Theories and Topics in Cognitive Science**: In industry research, context-dependent understanding of human behaviour and cognition is at the forefront. My job is to try and uncover - How this specific user of this specific product will think and behave in this specific context. My exposure to diverse areas such as attention, perception, and decision-making during my master's program has been indispensable in identifying and offering researched backed solutions, a bridge between theory and application, to practical problems. These solutions need to be quickly validated or extrapolated according to the context. Sometimes, half the battle is won by simply knowing what to look for and where the possible answers can be.

3. **Methods to Study Behavioral Phenomena**: As mentioned above, I often grapple with constraints such as limited time, budgets, and control over variables. In CBCS, I was introduced to a varied set of research methodology which has equipped me with creative methods to address the questions posed by stakeholders.

All of these three lessons are an integral part of my role as a User Researcher. However, having graduated just a couple of years back, I haven't had the opportunities to incorporate all of them yet in my work, but I can foresee their application. The attempt is to keep all these learnings close by, go back to them when needed and add onto what I have learnt.

My current position as a user researcher at Punch focuses on predicting behaviour of Indian retail traders, and this understanding informs product designs, marketing strategies, and business decisions. While some initiatives originate within the user research team, more frequently, stakeholders approach us with specific questions, prompting us to provide answers to them. This requires comprehensive end-to-end research planning, conducting user interviews, surveys, tasks, data analysis, and synthesis of insights. In essence, I advocate for the user's perspective within the company, and the insights gathered from my work can serve at any and every part of the company.

This implies, there are aspects of my role that entails skills and knowledge beyond what I have acquired at CBCS, including real-world problem-solving, proficiency in qualitative research methods, adept project and people management, and the ability to advocate for the importance of user research. Fortunately, the intensive coursework at CBCS has equipped me with the capacity to continuously acquire and apply these skills.

My journey at CBCS has not only deepened my understanding of the human mind but has also given me a chance of self-discovery. It has instilled in me the habit of questioning my actions, both in my personal and professional life. The belief that education enriches not only our careers but our lives as a whole, has grown only stronger through this experience. I owe a significant part of who I am today to CBCS, and for that, I will be always grateful.

Ishan Singhal (M.Sc 2016-2018)
PhD Scholar, IIT Kanpur

Chasing Curiosity: A Personal Odyssey through Cognitive Science at CBCS

I came to CBCS and cognitive science in 2016. Having just completed a BA in Psychology, Economics and Philosophy. My journey through cognitive science and its beginning at CBCS have both been serendipitous. Joining CBCS was not my first preference. At the time, I had wanted to go to IIT Gandhinagar. In fact, I had even missed the deadline for applying to the Centre. Had the deadline not been extended by a week, I wouldn't be writing this article and nothing of what I write below would have happened.

I had never intended to be in academia. I came into my master's with no knowledge of what a PhD is and how one goes about getting one. I had no idea that one could propose an entirely novel research area just out of self-interest and get paid for it! I had come to cognitive science to learn consumer behaviour. I had already spoken to a prospective employer and informed a company known for being "behavioural architects" that I would be bothering them incessantly for a job in 2 years. CBCS changed all of this. Somehow the Centre made me curious. I do not know how, nor can I give you any advice. I think there are two kinds of ways that life changes for people. One, through a process philosophy, where a person puts in effort and discipline in bringing about real change and progress in their lives. Or second, through serendipity. Though I think there are places more open to serendipity. CBCS for me, and for many others I know, is that place. Somehow, I ended up at the Centre. And somehow through the Centre curiosity came for me.

Somehow, I began a PhD here, and somehow award-winning contributions to consciousness science came to me. In the present day, I do not see a better place to go to learn the foundations of cognitive science. There is no place better equipped to go to to fall into the pursuit of studying some aspect of the mind. Not only academically, CBCS contributed to all aspects of my life. The three of the most amazing people I met in my life, I met at the Centre. One of them became my supervisor, one my wife and the third an exemplar. Before I could finish, I had to transfer away from the Centre. However, CBCS will always be an island of serendipity for me. And for that I owe it my utmost gratitude.

As for what I do now, I am about to submit a doctoral dissertation titled 'Temporal Properties of Consciousness'. Over the last five years, I have looked at empirical, phenomenological and philosophical aspects of the temporal properties of our experience. Specifically, to look for invariant properties of how our experience evolves, persists, endures, switches, resolves and devolves in time. My research involves looking at a theory of experienced time which can inform the inquires of dynamics of cognition and time perception. My work aims to enrich representational systems in cognitive science through adopting principles relevant to account for temporal experiences. Through this and more, I aim to unify the disparate findings in cognitive and consciousness science.

The major contribution of the work I did as part of my dissertation is of providing three properties of mental representations. All of this has been in an attempt to show that time is an intrinsic and necessary property of representations, when these representations are about our experience.

In my work I have argued that all representations of experience must (1) match in its temporal structure with the unfolding of experience, (2) have a reciprocal temporal correspondence between timing of an experience and the temporality of the experience itself, and, (3) account for different aspects of our experience evolving and devolving over multiple timescales. In my work, I have presented both phenomenological and empirical evidence for these postulations. I do not go into details of these constraints or empirical studies here. However, in my opinion, these constraints offer a way to create representational systems that accurately represent temporal experience, all the while being amenable to accommodating a theory-neutral understanding of time.

STUDENT CORNER

AI-Based Therapy: Promises and Perils

The world has witnessed the fast emergence of artificial intelligence (AI) and its revolutionary influence across multiple industries in recent years. Artificial intelligence (AI) has made advancements in the field of mental health, providing novel treatments such as AI-based therapy. AI-based therapy undoubtedly offers various advantages. Its capacity to analyze enormous amounts of data allows for the early diagnosis of mental health issues and prompt treatments that may save lives. The availability of AI-based treatment addresses the critical issue of mental health care shortages, making assistance available to individuals living in remote locations or with little financial resources.

Furthermore, AI's ability to deliver personalized treatment regimens based on individual requirements has the potential to transform mental health care completely. It can provide a variety of therapeutic methods, such as cognitive-behavioural therapies and mindfulness exercises, to accommodate a wide range of preferences and treatment objectives. In today's fast-paced environment, AI-based treatment may be available 24 hours a day, seven days a week, offering constant monitoring and assistance that human therapists cannot match.

However, to create a balance between innovation and humanity in mental health treatment, we need to tread carefully as we accept this cutting-edge technology. While AI's promise to enhance mental health therapy is exciting, integrating it into therapeutic practises brings substantial ethical problems and drawbacks. One of the most critical components of effective therapy is the human connection and the ability of therapists to empathize with their patients. No matter how powerful AI becomes, it will never be able to grasp human emotions or deliver genuine empathy. A lack of empathy can be especially harmful to those seeking assistance at times of vulnerability and hardship. Human therapists can detect tiny clues, validate feelings, and respond compassionately, fostering a therapeutic atmosphere that promotes trust and healing. Patients may experience emotions of loneliness or inadequacy if AI therapists lack this emotional connection.

Another issue is the cultural insensitivity of artificial intelligence. AI systems are only as good as the data on which they are trained, and data bias is a problem in and of itself. If AI therapists have been trained on biased information, they may unintentionally reinforce preconceived notions or provide incorrect recommendations. Furthermore, AI may need help understanding the nuances of culture and unintentionally neglect the unique experiences of people from various backgrounds. This lack of cultural awareness may result in incorrect diagnosis or treatment suggestions, worsening rather than alleviating mental health concerns.

The ethical concerns regarding data privacy are another issue altogether. Using AI for treatment necessitates collecting and analyzing massive volumes of sensitive personal data. This data may contain medical histories, emotional states, and behavioural patterns, making data privacy and security a top priority. The possibility of data breaches or the abuse of sensitive information is high, with serious consequences for people's lives and reputations. Individuals may be unwilling to seek treatment if they worry their private information will be disclosed. Therefore, the ethical obligation to secure sensitive data should not be taken lightly.

The future of AI-based treatment is integrating it alongside traditional mental health care rather than completely replacing it. As we welcome this breakthrough, we must remember that AI should supplement, not replace, the necessary human touch in therapeutic practice. Human therapists will always be indispensable in comprehending the complexities of human emotions, creating a safe environment for vulnerability, and giving a depth of emotional support that machines cannot match.

While artificial intelligence has enormous promise for revolutionizing mental health care, we must negotiate its use with a deep understanding of the ethical concerns it raises. Some ethical aspects that require careful study include ensuring the privacy and security of patients' data, resolving prejudices and cultural sensitivity difficulties, and maintaining the critical human connection in therapy. As we move forward, finding an acceptable balance between maximizing AI's potential advantages and preserving ethical norms will be critical to the appropriate and successful use of AI as a therapy for mental health concerns.

By Utkarsh Shukla

Msc. Student (2022-2024)

Anthropology and Cognitive Sciences

Cognitive science is usually described as the conjunction of cognitive psychology, philosophy, neuroscience, artificial intelligence, linguistics, and anthropology to understand cognition from a multi-faceted point of view. At least that's how it started. In this alliance, the distance between anthropology and the rest of cognitive science only grew as time went on from the inception of Cognitive Science. Anthropology is described as "the science of humanity," which studies human beings in aspects ranging from the biology and evolutionary history of Homo Sapiens to the features of society and culture. Anthropology encompasses a diverse subject matter.

By the 1950s, presaging the cognitive revolution, the subfield of cognitive anthropology emerged out of a blend of linguistic and sociocultural anthropology. Culture would be "whatever it is one has to know or believe in order to operate in a manner acceptable to its members, and do so in any role that they accept for any one of themselves" (Goodenough, 1957, p. 167). Cognitive anthropology moved in step with other areas of cognitive science, exploring various theories of representation of meaning—roughly in order: features, prototypes, fuzzy categories, schemas, and mental (cultural) models—and the exchange involved two-way traffic in ideas. cognitive anthropologists sought to model cultural processes as emergent properties of systems of interacting agents (Hutchins & Hazlehurst, 1991, 2002; Kronenfeld & Kaus, 1993).

In the subsequent years the rift between anthropology and cognitive science broadened as the difference between the methods grew too far apart. The difference between positivistic and post-modern approaches became clear in anthropology as cognitive anthropology became secluded from the rest of the anthropology subfields. As this was going on the rift between cognitive anthropology and cognitive psychology also grew as the former focused on content (not process), communities and social contexts (not individuals), natural settings (not labs), capturing real-world phenomena, even if it requires some relaxation of rigor, and worries about whether data collected actually mean what they may seem to mean on first glance.

Cognitive psychologists begin by reflecting on the accumulated knowledge of the discipline, formulate hypotheses, and invent research strategies to test these hypotheses in artificially created situations which, ultimately, are intended to clarify the phenomenon: the world which exists out there, beyond the laboratory. Anthropologists, by contrast, typically reverse this intellectual trajectory, and start with the phenomenon: the everyday process of life as it unfolds, for example, in a Malagasy village. Then, by means of speculative reflection and the use of accumulated theoretical knowledge, they identify the general processes that have contributed to the occurrence of the phenomenon. Anthropologists do not create a laboratory for "as if" occurrences because it is real occurrences, in all their complexity and uniqueness, which they aim to study.

The indifferent relation between anthropology and cognitive science does not make sense as the content-process distinction does not hold merit as both are equally important for a deeper understanding of human behavior. Research indicates that the social and material world participates in the organization of cognitive processes. For example, one cannot ask about the development of children's autobiographical memory in isolation because that depends on parent

speech to children, which varies substantially across cultures (Miller, Cho, & Bracey, 2005; Wang, 2006, 2007).

Even the theory of mind development depends on social context and varies across cultures (Liu, Wellman, Tardif, & Sabbagh, 2008; Lu, Su, & Wang, 2008; Tardif, Wellman, & Cheung, 2004; Wellman, 2002). Some neuroscientists now believe that the very architecture of the adult brain is affected by the organization of lifelong experience (Quartz & Sejnowski, 2002).

Biological anthropology contributes to our understanding of the evolution of mind and the evolution of the capacity of culture through animal and primate cognition. Linguistic anthropology continues an active exchange with cognitive science via pragmatics, conceptual processes, and studies of gesture.

Though there was a huge disjunction in the past, anthropology can be valuable asset to the cognitive sciences as it gives a new and open perspective about the human cognition through the history and evolution of the species homo sapiens.it will not be easy but identifying common goal and shared interests, having people from both fields sincerely collaborate and providing input in each other's work and prove beneficial to draw both of the fields together and in doing so making cognitive science a much more robust field than it already is.

- **By Sumit Sannamath**

Msc. Student (2022-2024)

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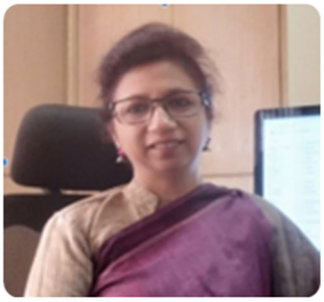

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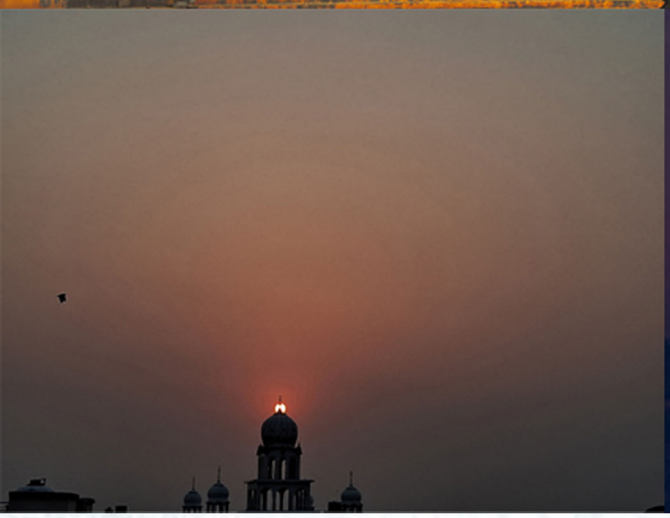
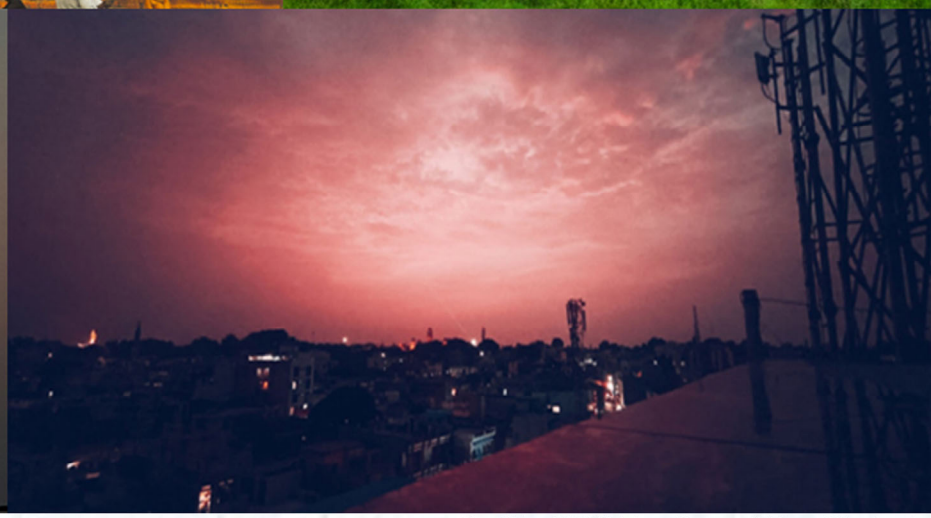

Credits: CBCS Msc. Second Year Students

CBCS, India's pioneering institute in Behavioural and Cognitive Sciences, leads in instructing students on theories, methods, and technologies for studying cognitive processes. As the first to introduce a Master's program in Cognitive Science in India, CBCS now offers Master's, Integrated PhD, and PhD Programs. More than 250 students have graduated from the center since its inception. In alignment with its vision, CBCS alumni have significantly contributed to establishing Cognitive Science programs and departments across the country.

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