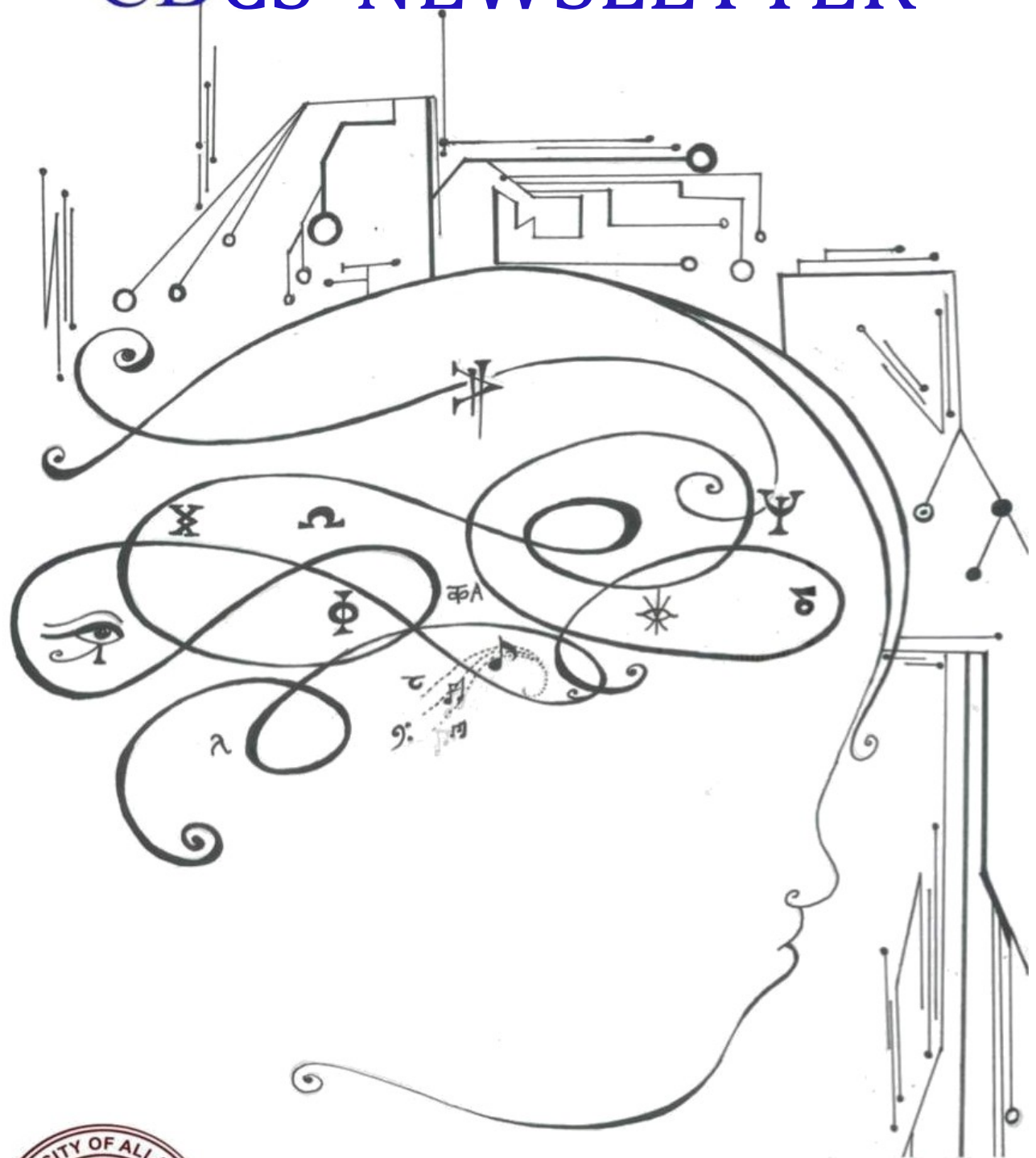


# CBCS NEWSLETTER



## About CBCS



**Prof. Bhoomika.R.Kar,**  
Head, CBCS

Centre of Behavioural and Cognitive Sciences is a pioneering institution for Cognitive Science in India. The Centre has been focused towards quality teaching and research and it reflects in the placements of students' post-masters and post PhD. This year, our students have been offered admission to doctoral programs at Institutions like University of Guelph, Canada, University of Florida, Michigan State University, Florida State University, USA, SWPS University of Social Sciences and Humanities, Poland, and IIT Kanpur to work on varied research areas such as moral decision making, cooperation, consciousness, emotions, metacognition, and role of numeracy in decisions under risk and uncertainty.

The interdisciplinary nature of Cognitive Science has proved its potential for maximizing human capabilities and solving human problems. Research at the Centre focuses on understanding the mechanisms of cognitive processes such as attention, decision making, actions, language processing, cognitive control, and emotions using different methodologies like behavioural experimentation, EEG/ERP, eye tracking, virtual reality, and computational modelling. In addition, the faculty and students at the Centre also seek to understand the mechanisms and implications of phenomena such as bilingualism, anxiety, cognitive and emotional aging, cognitive affective development in children, consciousness and meditation. The Centre faculty and students have also initiated studies using the fMRI facility established recently with the support from the Department of Science and Technology, Govt of India (for call for proposals visit: [http://cbcs.ac.in/wp-content/uploads/2019/12/Proposal-Form\\_NNF\\_Final\\_Dec\\_2019.pdf](http://cbcs.ac.in/wp-content/uploads/2019/12/Proposal-Form_NNF_Final_Dec_2019.pdf)). Recently, we have conducted a study on the effect of solar eclipse on resting state functional connectivity in collaboration with Auburn University, USA. The Centre conducted a five-day workshop on Neuroimaging research design and analysis in February, 2020 with hands on training with the fMRI facility at the Centre. With these advanced research facilities, the Centre aims to also move towards applied research on cognitive disorders such as generalized anxiety disorder, depression, autism, and dementia along with its focus on basic research. During these trying times due to the pandemic we admire and respect the patience and perseverance of our students for keeping up their motivation for learning and working towards building their knowledge base in cognitive science. This has been the most difficult time for research. Researchers have been trying to develop the best possible controlled methods for remote experimental research.

## Events

### **8<sup>th</sup> Regional Brain Bee (Neuroscience Quiz), 8<sup>th</sup> February 2020.**

Brain Bee is a non-profit neuroscience quiz for high school students conducted in various countries across the world. It is an attempt to motivate students to learn about the brain and inspire them to pursue careers in brain research. In Allahabad, the Centre of Behavioral and Cognitive Sciences (CBCS) have been hosting this competition since 2013. This year, the Allahabad Regional Brain Bee (ARBB), a neuroscience contest for 11<sup>th</sup> grade students, was hosted by the CBCS on February 8<sup>th</sup>, 2020. The technical team of ARBB included CBCS members, chiefly, Prof. Bhoomika R. Kar, Dr. Saraswati J. Yadav, PhD scholars and Master's students.

Twenty-four students from 12 schools and colleges from Allahabad participated in the event. The competition consisted of a written test followed by oral rounds consisting of three phases, with increasing level of difficulty. The judges were Dr. Chhitij Srivastava, Associate Professor at Motilal Nehru Medical College, Allahabad and Dr. Saraswati Yadav, Post-doctoral Fellow at the Centre of Behavioural and Cognitive Sciences, University of Allahabad.



The 2020 ARBB winner is Pranjali Pant from Maharishi Patanjali Vidya Mandir, Teliyarganj. The first runner-up is Astha Patel from Delhi Public School. The second runner-up is Anshita Srivastava from Maharishi Patanjali Vidya Mandir, Teliyarganj.

The Winner was supposed to participate in the 13<sup>th</sup> Indian National Brain Bee to be held in April, 2020 at NIMHANS, Bangalore but the event was cancelled due to COVID-19. This event has established a platform to foster interest in neuroscience education at the school and college level in the city of Prayagraj.

## Workshop on Cognitive Neuro-imaging 21<sup>st</sup>–25<sup>th</sup> February 2020

The Centre of Behavioral and Cognitive Sciences, University of Allahabad organized a workshop on Cognitive Neuroimaging from February 21<sup>st</sup>, 2020 to February 25<sup>th</sup>, 2020. Prof. Bapi Raju, IIIT Hyderabad, Dr. Srikanth Padmala, Assistant Professor, Centre for Neuroscience, Indian Institute of Science (IISc), Bangalore and Mr. Lakshman, Research Associate, Centre for Neuroscience, IISc, Bangalore were the resource persons for the workshop. The goal of this 5-day workshop was to provide hands-on experience with functional Magnetic Resonance Imaging (fMRI) experimental design, acquisition, and analysis of fMRI data for advancing cognitive neuroscience research in India. Since this will be an intermediate-level workshop with brief introduction to fMRI methodology, this workshop was mainly targeted at advanced PhD and postdoctoral level scholars who have planned to use fMRI methodology to address their targeted research question(s). This workshop covered fMRI design strategies, acquisition of task-related fMRI data (a few participants data was also acquired during the workshop), pre-processing and analysis of fMRI data at single-subject as well as group level. Participants learnt fMRI data analysis using AFNI with sample data sets during the lab sessions. Towards the end of the workshop, actual fMRI experimental designs proposed by participants were discussed and valuable feedback from the experts certainly provided useful insights into the specific issues related to fMRI experimental design. Overall, the emphasis of this workshop was on how to use fMRI as a tool to address research questions in Cognitive Neuroscience. Twenty-three scholars from various institutions like IIT Kanpur, IIT Gandhinagar, IIT Delhi, IIIT Hyderabad, ISI Bangalore, IIIT Allahabad, Department of Psychology, AU and CBCS participated in the workshop.





## **Webinar on Social-emotional-Cognitive Health of Children June 26, 2020**

On the behalf of the National Academy of Psychology, India, a webinar was conducted on "Social-emotional-Cognitive Health of Children in this pandemic" on June 26, 2020.

### **Speakers**

1. Prof. Nandini. C. Singh, Senior Project Officer at UNESCO Mahatma Gandhi Institute of Education for Peace and Sustained Development, New Delhi
2. Dr. Madhavalatha Mangati-Kari, Head, Department of Psychology, Ashoka University, Sonapat, Haryana
3. Prof. Srinivasan Venkatesan, Head, Department of Clinical Psychology, All India Institute of Speech and Hearing, Mysore

Moderator: Prof. Bhoomika R. Kar, Head, Centre of Behavioural and Cognitive Sciences, University of Allahabad, Prayagraj.

During the early years, children's experiences affect their thoughts, emotion and behavior. Child's experiences affect the way they perceive a stressful situation and respond to stress. Corona virus disease 2019 has changed the psychosocial environment due to isolation, contact restrictions, change in the teaching and learning patterns, changed routine, and uncertainty, which can profoundly affect the social-emotional-cognitive health of children. This webinar focused on: a) effect of COVID-19 pandemic on normal ongoing social-emotional-cognitive development b) mental health issues in children due to this pandemic situation and the effect of this situation on children with cognitive disorders; c) long term effects of the pandemic on social emotional cognitive health of children and how parents, teachers and professionals could intervene to reduce the risk for mental health issues in children and to build resilience among children to promote optimal social-emotional-cognitive development. Prof. Nandini Singh introduced the concept of social emotional competence. She also discussed the highlights of the social emotional learning program developed by MGIEP and emphasized the need for being mindful and for encouraging digital applications to foster social emotional cognitive health of children. Dr. Madhavi Mangati discussed about how parents and their children with neurodevelopmental disorders are coping during the pandemic and the implications for research and policy. With an emphasis on enhancing cognitive development, she spoke about the importance of play and the need for capacity building of community health workers and parents. Prof. Venkatesan Srinivasan focused on Social-Emotional-Cognitive Aspects of Children especially for those at risk for Cognitive Disorders and how to identify and manage the mental health issues in such vulnerable contexts. The webinar ended with a discussion on future prospects for research and application related to social emotional and cognitive health of children.

## Congratulations!

### Faculty Positions



#### Dr. Saraswati Jaiswal Yadav

Dr. Saraswati Jaiswal Yadav has joined as Associate Professor in the Department of Physiology at Motilal Nehru Medical College, Allahabad. She worked as a Postdoctoral Fellow at CBCS where she studied: “*Modulatory effect of reward prospect on the characterization of trait anxiety*”. Her project was funded by the Department of Science and Technology, Gov. of India under the Cognitive Science Research Initiative scheme.

### Postdoctoral Position



#### Mr. Indrajeet

Indrajeet has been awarded a postdoctoral fellowship in the lab of Dr. Mati Joshua, at the Edmond and Lily Safra Center for Brain Sciences (ELSC), the Hebrew University of Jerusalem, Israel for a period of two years. He will investigate how reward influences the ability to control pressing urges and movements. Indrajeet recently submitted his D.Phil. thesis entitled “Influence of Attention on Control of Action” supervised by Dr. Supriya Ray.

### PhD Programmes

Supratik Mondal



SWPS,  
University of  
Social Sciences and  
Humanities  
Area of research:  
Numeracy and  
decision making

Niyatee Narkar



Cognitive-Affective  
Neuroscience Lab,  
University of Guelph, Canada  
Area of research:  
Emotion perception

Trisha Dutta



Dept. of Social Psychology  
Florida State University,  
USA  
Area of research:  
Moral reasoning

Shree Vallabha



Michigan State  
University, USA  
Area of research:  
Morality and cooperation

Saurabh Ranjan



University of Florida,  
USA  
Area of research: Metacognition

Ramya M



Interdisciplinary Program  
Cognitive Science,  
IIT Kanpur  
Area of research: Consciousness

Roshan Jayarajan



Interdisciplinary Program  
Cognitive Science,  
IIT Kanpur  
Area of research: Decision making

## Industry:

Parika Kumar



Associate Quality Researcher  
Centre for Social Behavior and Change,  
International Foundation for Education  
and Research

Muhasin Rashid



Internship  
SIEMENS, Bangalore

Hariharan



Internship  
SIEMENS, Bangalore

## Research Article



### **Enhanced anticipatory and proactive inhibitory control processing among Hindi-English bilinguals**

**Jay Prakash**

PhD, CBCS

University of Allahabad

India is a country with a lot of language diversity. Most of the Indian population is bilingual or multilingual. A person who uses two languages for reading, writing, or speaking in their daily life is considered a bilingual. Using two languages may involve shifting between the languages which requires mental flexibility. Using one language at a time for bilinguals requires greater attentional control as compared to monolinguals. Attentional control has been measured using various cognitive tasks such as Flanker task, Simon task, attention network task and Stroop task. These tasks require participants to make a key press response based on the appearance of the target on the screen in accordance to the given instructions. Enhanced cognitive control means faster response with greater accuracy for bilinguals as compared to monolingual peers. Bilingualism can be profiled in terms of degree of bilingualism (language proficiency), bilingual experience and switching between the languages. In the present work, we examined language proficiency and its interaction with attentional control. Proficiency indicates expertise in a particular language and research suggests that language proficiency also enhances attentional control. The effect of second language proficiency (English) on attentional control among Hindi-English bilinguals was examined. We investigated two cognitive processes- anticipation, and proactive inhibitory control. Preparation for response based on prior or contextual information is anticipation, for example in a sport, a player prepares in advance to make a response (hit) based on opponent player's moves. Proactive inhibitory control refers to inhibition of response tendencies in advance based on prior information. Inhibition is stopping a motor movement, e.g., stopping a car at the appearance of a red signal. Proactive inhibitory control inhibits a motor movement in advance, e.g., slowing down a car by putting brakes after seeing a danger signal to avoid any upcoming conflict. Anticipation is a core aspect of proactive inhibitory control, which makes it interesting to investigate both of these cognitive processes in the context of bilingualism. Second language (English) proficiency was measured using language background questionnaire, picture description task, and LexTale (lexical decision task) test. The participants were divided into two groups- high-proficient and low-proficient bilinguals, based on LexTale score, picture description task and self-rated proficiency in the second language (English) with comparable proficiency in the first language (Hindi). Traffic light task was administered to tap anticipatory response and cued Go/No-Go task was administered to tap proactive inhibitory control. Responses were collected using Eye tracking methodology; the participants were instructed to make eye movement responses.



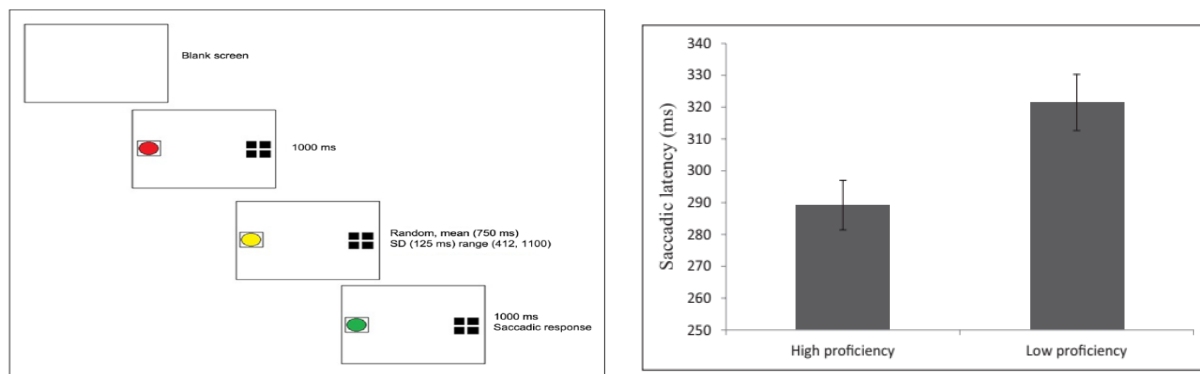


Figure 1. Presenting the traffic light task for (left) anticipation and the mean comparisons between high- and low- proficiency bilinguals (right).

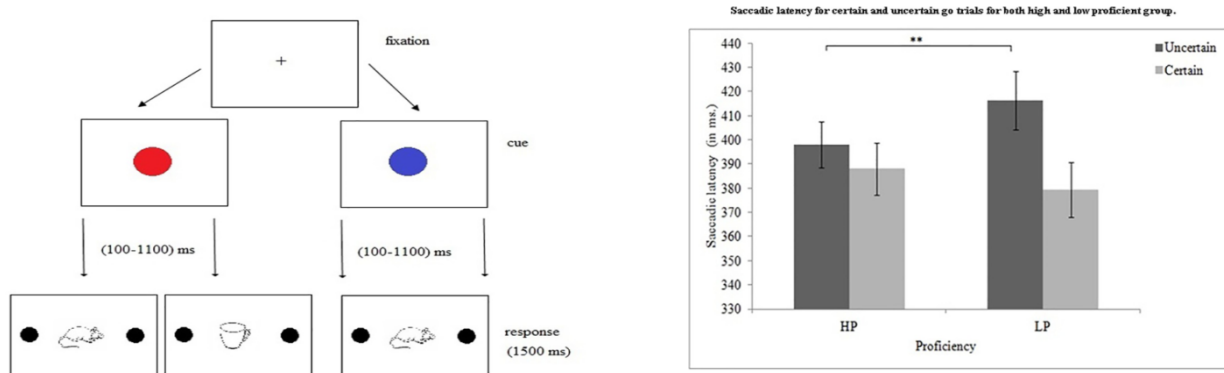


Figure 2. Presenting the cued Go/No-Go task (left) for proactive inhibitory control and the mean comparisons between high- and low- proficiency bilinguals (right)

Overall results suggest that high-proficient bilinguals were faster than low-proficient bilinguals in the traffic light task and the cued Go-NoGo task (Figure 1 & 2). Faster response in the traffic light task suggests that second language proficiency modulates anticipatory cognitive processes which indicate that high proficient bilinguals were better at planning and execution of eye movements. These findings are novel in terms of better performance of high-proficient bilinguals even when there was no conflict situation present in the task. In the cued Go/No-Go task, there were three types of trials, namely, certain go, uncertain go, and uncertain No-Go. High-proficiency bilinguals were faster than low-proficient bilinguals on ‘uncertain go trial’ condition, which suggests that high-proficient bilinguals are better at using proactive inhibitory control as compared to low-proficient bilinguals. High proficient bilinguals also showed reduced proactive inhibitory cost compared to low proficient bilinguals. Linear mixed effect analysis further showed that high proficient bilinguals showed an advantage related to faster release of inhibition with faster saccadic latencies on the uncertain go trials when the previous trial was an uncertain no-go trial. Overall, the results indicate that second language proficiency modulates anticipatory ability and proactive inhibitory control.

### Source articles

Singh, J. P. & Kar, B. R. (2018). Effect of language proficiency on proactive occulo-motor control among bilinguals. *PLoS ONE* 13(12): e0207904. doi.org/10.1371/journal.pone.0207904

Singh, J.P. & Mishra, R.K. (2015). Effect of bilingualism on anticipatory oculomotor control. *International Journal of Bilingualism*.doi:10.1177/1367006915572398



## Efficacy of inhibitory control depends on procrastination and deceleration in saccade planning

**Indrajiet**

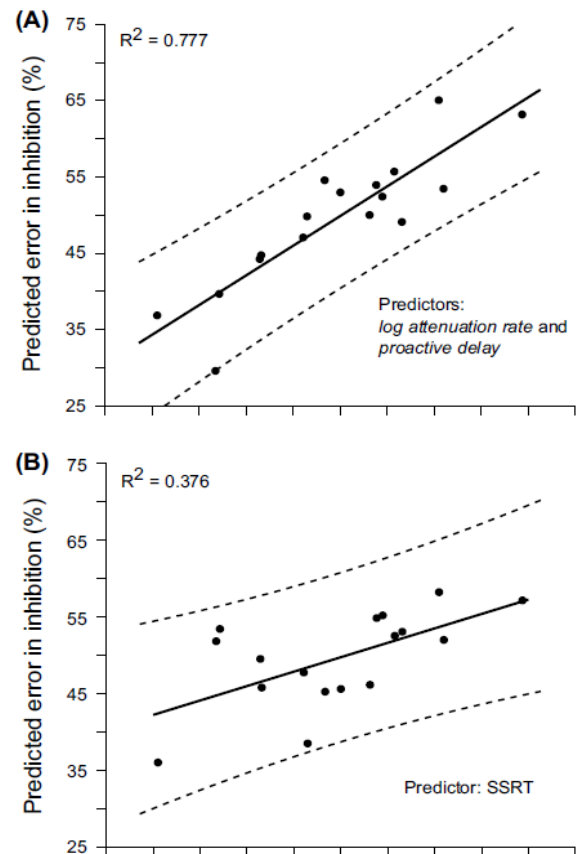
Doctoral Student, CBCS  
University of Allahabad.

Lack of self-control is implicated in craving for junk food, addiction to Smartphone, procrastinating deadline-critical tasks, skipping workout, obsession to fantasy, outburst in anger, and so on. Many of our miseries including obesity, smoking, alcoholism, mobile/internet addiction, drug-abuse, rash-driving, domestic violence, relationship issues and so on, can be alleviated by scientific knowledge of self-control.

One aspect of self-control is the cancellation of impending movements at will. I investigated whether we can control our tendency to look at tempting attractive visual things when instructed. We continuously recorded where a person is looking using specialized high speed (240 times per second) video-cameras, called infrared eye-trackers. We programmed a task on a computer, like a video game, which was a simplified version of controlling or inhibiting a prepotent response called stop-signal task. In the task, a small square in white colour was displayed at the centre of the monitor and participants were instructed to look at it. After few times, the square disappeared and another square appeared at the periphery. The disappearance of the central square acts as a go-signal instructing participants to look at the peripheral square. However, in 40 % of trials, the square at the centre reappeared after a variable interval from its disappearance. The re-appearance of the central square acts as a stop-signal instructing participants to control the urge to look at the peripheral square.

Race model suggests that a go signal triggers a process (GO) in the brain that starts running, and if and when stop signal appears a STOP process starts running too. If the go process reaches a fixed threshold (a hypothetical finish line) first, the response is made. If the stop process touches the finish line before the go process, the response is cancelled. The race model can also tell us how much time a person takes in cancelling the response. This duration is called stop-signal response time (SSRT), which is commonly around 1/4<sup>th</sup> of a second.

In contrast, another recent model that endorses that GO and STOP processes do not race; rather, the go process is decelerated (continuous slow down) if the stop signal is detected timely. This is similar to when the rider pulls the rein to stop a horse if timely notices a ditch. The model is known as cancellable rise to threshold (CRTT) model. If the stop signal is detected in time and amount of deceleration is reasonable the go response is inhibited. In this paper, we showed that



*Note: Regression models were built to compare the amount of error in cancellation explained by CRTT metrics and SSRT. It shows that CRTT metrics (Fig. A) can explain the two folds of the error explained by SSRT (Fig. B).*

how strong the brain should pull the rein to slow down the go process called log-attenuation rate; and procrastination in generating the go response in expectation of stop signal determines called proactive delay determines the success in cancellation of the impending movements. We proposed log-attenuation rate and proactive delay as method to quantify the ability to cancelled impending movements. These metrics overcomes the limitations of tradition SSRT method and explains more percentage of error in cancellation (inhibition).

In this paper, we showed that two factors, how strong the brain pulls the rein to slow down the go process (i.e. log-attenuation rate) and how long it tends to procrastinate (i.e. proactive delay) the elicitation of the go response in expectation of the stop-signal, determine the success in cancellation of the impending movement. We proposed a method to quantify an individual's ability to cancel an impending movement in terms of log-attenuation rate and proactive delay. These metrics overcome the limitations of race model and explain the data better than the traditional metric (i.e. SSRT) of stopping.

*Source article:*

Indrajeet, I. & Ray, S. (2020). Efficacy of Inhibitory Control Depends on Procrastination and Deceleration in Saccade Planning. ***Experimental Brain Research***  
(<https://doi.org/10.1007/s00221-020-05901-z>)

## Achievements

### Awards/Honours/Fellowship received:



**Dr. Amrendra Singh**

Dr. Durganand Sinha, Best Dissertation Award (In Top 5), Annual Convention of National Academy of Psychology- 2019.

**Title:** Meditation and perceptual experience.



**Dr. Jay Prakash Singh**

Dr. Durganand Sinha, Best Dissertation Award (In Top 5), Annual Convention of National Academy of Psychology- 2019.

**Title:** Anticipation and Cognitive Control among Bilinguals.

### Research Collaborations

Gopikrishna Deshpande, Auburn University, USA.

Project Title: Effect of Solar Eclipse on brain function

Michaela Redieger, University of Jena, Germany

**Narayanan Srinivasan:**

Virginie van Wassenhove, INSERM, Université Paris-Sud, France.

Project title: Time and Social Distancing.



## Publications

- Battu, B., & Srinivasan, N. (2020). Evolution of conditional cooperation in public good games. *Royal Society Open Science*, 7:19156.
- Dash, T. & Kar, B. R. (2020). Behavioural and ERP correlates of bilingual language control and general- purpose inhibitory control predicted by L1 and L2 proficiency, *Journal of Neurolinguistics*, 56 doi.org/10.1016/j.jneuroling.2020.100914.
- Indrajeet, I. & Ray, S. (2020). Efficacy of Inhibitory Control Depends on Procrastination and Deceleration in Saccade Planning. *Experimental Brain Research* <https://doi.org/10.1007/s00221-020-05901-z>
- Kerusauskaite, S., Simione, L., Raffone, A., & Srinivasan, N. (2020). Global-local processing and dispositional bias interact with emotion processing in psychological refractory period paradigm. *Experimental Brain Research*, 238, 345-354.
- Nigam R. & Kar, B. R. (2020). Cognitive Ageing in developing societies: An overview and a cross sectional- study on young, middle- aged and older adults in Indian context. In the Special issue on Aging in developing societies, *Psychology and Developing societies*. [doi.org/10.1177/0971333620937511](https://doi.org/10.1177/0971333620937511)
- Ray, S.B., Mishra, M.V., & Srinivasan, N. (2020). Attentional blink with emotional faces depends on emotional expressions: A relative positive valence advantage. *Cognition & Emotion*.

## In Conversation



**Prof. Bapi Raju S**

Professor, International Institute of Technology, Gachibowli, Hyderabad.

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

I'm in general interested in applying computational methods for cognitive science questions as well as conducting empirical experiments for obtaining insights about how the brain and mind lead to or mediate behaviour. Current focus is on applying graph theoretic methods to characterize the structure and function of the ageing brain and how this breaks down in diseases such as dementia. I'm also interested in the general question of how consciousness is related to brain activity and how volitional control ("will") emerges from the interaction of neuronal networks.

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

I work with both computational methods as well as empirical approaches, so the challenge is always to keep up with the progress in these areas. It is also a challenge to train research students starting out in these areas. We usually emphasize in our lab for people to work in two of the three focus areas – computation, experiment and theory. Since Cognitive Science in general is still in infancy in India, it is a challenge to have a peer group to talk to. Most of the time you and your graduate student are the only ones to share the trials and tribulations! This gets to be lonely at times!

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

Since most of the work in Cognitive Science, with emphasis on Neuroscience, requires one to be conversant with both the latest in experimental methods as well as statistical analysis approaches, it is important for the new students to start developing a healthy attitude toward quantitative methods. I feel, first off, that this is about attitude and not just about capabilities. Skills and capabilities can be acquired with the right mind set! Since we are in interdisciplinary research, let us own up everything -- be it learning new mathematical theories relevant for our work, be it appreciating the latest experimental method proposed by a paper or be it the new philosophical conundrum tossed at us! We're open and ready!

### **3. Challenges in your field of research and new discoveries related to methods and applications.**

While increasingly publicly accessible datasets are available, the computational infrastructure and the support needed to exploit the resources also needs to ramp up in every educational institute in India. The other issue that I think routinely research students face is posing the right questions. Although datasets and tools are available, especially in the domain of computational neuroscience, right questions are hard to come by. Lot of investment of intellectual effort as well as time needs to be made to address this issue. One fertile area to look at is characterizing the dynamics of brain activity. There has been much work exploiting the average functional connectivity (“connectome”) but “dynome” of the brain is still up for grabs. Such understanding of the dynamics of the brain is bound to have interesting clinical applications.

## Alumni Corner



**Dr. Devpriya Kumar**

Assistant Professor, HSS, IIT-Kanpur

*Long ago . . . it must be . . .  
I have a photograph  
Preserve your memories*

My first recollection of CBCS has been as a UG student in the psychology department, wondering what kind of experiments they want to conduct on us. We used to always look at the place as an ivory tower in the middle of the university culture prevailing around it. With some twist of fate, the tables turned, and I joined the Master's program at CBCS. The year was 2007. It was challenging to explain to anyone what cognitive science is, let alone why I want to join the program.

Learning is a life-long process, but a lot of what I am today I owe it to the CBCS. I spent a long time as part of the center (nearly seven years), and I can say that it was time well spent. During my masters, I got the opportunity to meet prominent figures from various fields, investigating different and equally exciting questions. Not only did I learn about cognitive science and the process of research, but I also got to know about life in general. The center provided insight into the teaching-learning process and played a crucial role in shaping me as a teacher and a researcher at IIT Kanpur. Even today, when I meet anyone from CBCS, staff members, teachers, and my chain-gang, we interact like family. I can go on and on, but unfortunately, this not my memoir. If you are alumni and reading this, you will relate to some of these memories (I might be a part of them). If you are currently a student, all I have to say is that the center has a lot to offer holistically, try to use its potential to the fullest. My only regret is not making most of my time at the center.



**Dr. Aparna Ranjan**

Quantitative user experience (UX) Researcher  
Facebook HQ in Menlo Park, USA

I am honored to contribute to the CBCS newsletter series. Thank you for your kind invitation! My journey in the area of psychology began at the University of Allahabad. While there I completed a BA specializing in psychology and an MA in cognitive science from the Centre for Behavioral and Cognitive Sciences. I am currently working as a Quantitative user experience (UX) researcher at Facebook HQ in Menlo Park, US. I use quantitative research methods and work closely with designers, data scientists and engineers to apply psychology research to human-centered product design and innovation.

How did I get to where I am today? CBCS gave me an amazing platform to learn and grow, and to follow my passion – when in Allahabad, I was very active in local theatre and also worked as a radio artist for 8 years at All India Radio. Professors at CBCS recognized my research strengths and interests in arts and theatre. They introduced me to the amazing field of the psychology of creativity (yes that is a real field!) and this helped me bring together my passion for arts and research! One major factor in getting me where I am today was realizing that I could study in the field of psychology but actually work in applied research and product design. The course on Human Computer Interaction at CBCS helped me see this connection. My professors at the Centre and guest lecture at CBCS from various renowned scientists of national and international repute also inspired me to pursue my passion, make connections in the field with other researchers, and exposed me to international research in other parts of the world.

After my masters I wanted to explore the applied side of research. Cognitive Science was a pretty new field in India in 2007 and not many IT companies hired researchers from the field of psychology. I was interviewed for a company in Pune, which I later joined. I was part of a newly formed interdisciplinary user experience team there. I got first-hand experience working with design teams and engineers which rekindled my passion for understanding how creativity and innovation work together. While working in an applied field in product design research, I became super curious and passionate about understanding the underlying cognitive processes of creativity and the crossover possibilities between the two areas.

So, I decided to pursue my PhD at the University of British Columbia; my research was about understanding the creative process across different artistic domains and how both personal style and inspirational source come together in the generation of a creative product. I proposed that creative ideas transcend domains. I completed a post doc at Yale University, where my research broadly focused on the psychology of creativity, the role of emotions and individual differences in creativity, and how self-regulation helps transform creative ideas into achievements. I also got the opportunity to do some research at Copenhagen Business School, where my research focused on understanding how culture shapes design thinking.

I enjoy my current job where I get to bring in my research expertise in cognitive science and experimental psychology and apply it to product innovation. I would encourage students reading this to be open to new things, take risks and enjoy the journey!

## Student's Column

### “How Private are your Thoughts?”

Though there are a number of approaches trying to dig open the mystery under the skull, let's have a sneak peek at two of such approaches. The Visual brain where mental imagery is extremely crucial gives the opportunity to encode its selective activation into representations that can be correlated to objects that are being imagined (Craven & Kanwisher, 2000). This process, for example, enables us to understand if one is thinking about a dog or not but doesn't go deeper into its intricacies. Now, a patient can move his/her wheelchair by just thinking of a rotating circle (Pearson, 2019). Using high-resolution fMRI studies, researchers can tell which alphabet a participant is thinking of (Senden et al, 2019). Although with the involvement of brain-computer interface and deep learning, understanding mental imagery has evolved a lot more in recent times. Yet mental imagery is regarded as a complex study.

The Auditory brain where encoding and processing of acoustic signals happen, gives the scope for extracting information on speech. Recent studies using an ECoG based implant placed over the skull could identify the neural signals leading to other body parts involved in speech production such as lips, tongue, larynx, and jaw. They then convert such signals into representations of movements from vocal tract articulators and then these are transformed into spoken sentences. Artificial neural networks are used in the whole process to address these complex temporal structures (Pandarinath & Ali, 2019). Although this entire process partially addresses the nuances of speech only when physical movement is present, researchers seem confident that this can be applied to verbal thinking as well, but with a rather profound understanding of neural networks associated with it. Also, they have shown that it is possible to convert neural representations into synthesized speech and this synthesized speech into spoken words. (Anumanchipalli, Chartier & Chang, 2019).

Both these approaches seem closer to their goal of understanding human thought and quest for extensive amounts of data to do the same. Solving this problem can lead to many benefits like addressing the problems in speech deficit patients with paralysis. On the other hand, it raises new questions like how private can your thoughts be then?

**Yengisetty Eswar Naveen**  
**MSc 3rd Semester, CBCS, AU**

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## The Editorial Board



**Prof. Bhoomika R. Kar**  
Chief Editor, Head CBCS



**Dr. Amrendra Singh**  
Post-Doctoral Fellow, CBCS  
University of Allahabad, Prayagraj



**Dr. Niharika Singh**  
Assistant Professor, CBCS  
University of Allahabad, Prayagraj



**Ganga Tiwari**  
PhD Student, CBCS  
University of Allahabad, Prayagraj



**Christelle Maria Lewis**  
M.Sc Student (2017-2019)  
Designed the cover page



## Talent @ CBCS



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# LEARNING BEYOND BOUNDARIES

CONSUMER CONNECT INITIATIVE

The demand for Cognitive Science that lends scientific insights into understanding core human processes has seen tremendous growth in India in the last two decades

## MIND matters

Prof. Bhoomika Rastogi Kar

Cognitive Science is an intellectual enterprise that seeks to answer fundamental and long-standing questions about the nature of mind and brain. The interdisciplinary nature of Cognitive Science has proved its potential for maximising human capabilities and solving human problems. Cognitive Science in India has seen tremendous growth in the last two decades, lending scientific insights into understanding core human processes like attention, perception, language, decision making, memory and consciousness. Such research has not only contributed to unravelling how the human mind behaves but also offered new tools to understand ailments like anxiety, depression, dyslexia, attention deficit hyperactivity disorder, autism, schizophrenia, and dementia.

The best way to move forward for a career in this very fascinating discipline for the aspiring students with a background (Bachelor's degree) in Psychology, Computer Science, Life sciences, Zoology, Mathematics, Physics, Engineering, other social sciences such as economics, anthropology and linguistics is to apply

for a Masters (MSc) programme in Cognitive Science and those with a Master's degree to apply for PhD in Cognitive Science. In India, there is no undergraduate programme in Cognitive Science, rather there are Masters and PhD programmes.

The first and pioneering centre to launch a Masters'



### CAREER PROSPECTS

Opportunities in the field of Cognitive Science include academics (as research scientists or faculty) and industry. The scope for those with research skills continues to grow rapidly. This is true not only for academia with plethora of students pursuing research programmes (PhDs) both from India and abroad and joining the ever-expanding community of cognitive scientists in India, but also for industry jobs.



### IT and Cognitive Science

By combining technical skills such as data analysis, programming with Cognitive Science, the opportunities are in artificial intelligence (AI), information architecture (IA), clinical research consulting, telecommunications, data representation and retrieval, human factors engineering and human computer interaction. Candidates, who have obtained a master's degree or doctoral degree in Cognitive Science, also get a better chance to secure many management and industrial research positions and all college-level academic research and teaching positions.

programme in Cognitive Science is the Centre of Behavioural and Cognitive Sciences (CBCS), University of Allahabad, Prayagraj, established as a UGC Centre with potential for excellence in 2002.

In principle, any industry seeking to understand human behaviour has a job for cognitive scientists. As such, advertisement firms recently have adopted a research-oriented method of appealing to customers, leading to substantial investment and growth in "neuro-marketing". An approach that looks at experimental tools to understand appeals of advertisements. This has also been adopted by NGOs and social behaviour firms to address persistent

human behaviour problems like breaking traffic signals, spitting in public and not wearing helmets.

Cognitive scientists in India have also been actively involved in social research in developing interventions for better sanitation, nutrition and hygiene for the Indian populace. Their data science skills have also seen growing demand in analysing socio-political surveys and polls.

Cognitive Science has a potential to be widely applied and has an exciting future.

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