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BRAIN STRUCTURES INVOLVED IN TIME PERCEPTION

Chandra bhushan Prasad
M.Phil., Roll No.: 141754 Session-2014-15
Department of Psychology, B.R.A. Bihar University, Muzaffarpur, India
E-mail: cbprasad5151@gmail.com

ABSTRACT

Over the course of the last several years, there has been considerable development in the field of instrumental examination and evaluation of consciousness and its disorders (DOCs, also known as coma, vegetative state/unresponsive wakefulness syndrome, or VS/UWS, and minimally conscious state, or MCS). This progress has resulted in, among other things, the transition from a singular way of looking at severe brain damage to a more graded nosology. This graded nosology is based on a quantitative assessment of consciousness and on functional neuroimaging technologies. Other benefits of this progression include: The so-called "neuro-technologies," in particular the application of technology to the evaluation and exploration of consciousness, have resulted to discoveries that are both stunning and unanticipated, and these results have profound theoretical and practical ramifications.

Keyword: practical ramifications, consciousness, profound theoretical,

INTRODUCTION

Although the technical advancements in the study of consciousness, particularly of its correlates, have been remarkable (even if several important questions still remain unanswered), the conceptual investigation of consciousness still seems to be slowed down by controversies regarding the amount of explanatory power that should be attributed to science, specifically empirical psychology and cognitive neuroscience, and how to handle the empirical evidence that emerges from these fields.

In the end, we still do not have a complete conceptual analysis of consciousness. This lacuna in the clarification of consciousness has the potential to have an effect on the scientific investigation itself: the meaningfulness of science is founded on background concepts that need to be made explicit, elaborated on, and analyzed from both a scientific and an extra-scientific point of view. To be more specific, knowledge in the field of neuroscience is normative in the sense that it is founded on presupposed models that render the findings of neuroscientific research scientifically valid, despite the fact that such research is still in its infancy. This is especially important when considering the study of subjective experience, which by its very nature must include both a third-person and a first-person point of view.

Immediately, there is a pressing need for a conceptual analysis of consciousness that attempts to combine both empirical and theoretical points of view. The purpose of this thesis is to provide a conceptual evaluation of consciousness by using a method that draws on a number of different academic fields.

When I say "conceptual clarification," I'm referring to two specific things in particular: 1) a philosophical analysis of the theoretical and epistemological premises and categories of science; and 2) the application of a naturalistically oriented philosophical reasoning, assessing the impact of scientific inductive and deductive explanations and justifications and their logical consistency. Both of these things can be broken down into smaller subcategories, but they both fall under the umbrella term of "philosophical analysis." As will be further stated below, I take it for granted that conceptual research is a component of a naturalistic philosophy, which means it has a strong link with empirical science.

In this regard, I adopt a particular stance in the debate over the theoretical importance of neuroscience for conceiving of consciousness. As will be stated in further detail below, I defend both the relevance of neuroscience for conceptualizing consciousness and the necessity to supplement neuroscientific study with explicitly philosophical reasoning at the

Chandra Bhushan Prasad*, *Department of Psychology, B.R.A. Bihar University, Muzaffarpur, India.*
E-mail: cbprasad5151@gmail.com

same time. Both of these arguments will be presented in more depth below. To some, this may appear to be a sort of compromise between scientific and philosophical reasons; however, I prefer to describe it as the simultaneous recognition of the inherent insufficiency and of the necessary complementarity of both science and philosophy in order to address the primary problem of determining the nature of consciousness. It is true that neuroscience is primarily interested in and focused on the conscious brain, avoiding reference to abstract and potentially misleading notions like consciousness as such; however, I believe that knowledge gained from the field of neuroscience is highly relevant for assessing the philosophical problem of the nature of subjective experience (for example, where does it come from? why is the brain conscious?). Can other things except humans have consciousness? (among other things) These are philosophical questions, more precisely metaphysical ones, and neuroscience does not take a stance that is neutral about them.

There is one more topic about the methodologies used in neuroscience that has to be mentioned. In spite of significant advances made in theoretical neuroscience, the field of neuroscience of consciousness is still primarily founded on an empirical and inductive technique at this point in time. As a consequence of this, the theoretical component of the neuroscientific investigation of consciousness is neither particularly mature nor sufficiently developed at this point. It's possible that the Integrated Information Theory (IIT) is the one and only exception. Notwithstanding this, I am of the opinion that its postulates are ultimately not properly justified. This means that they are not sufficiently anchored on the existing empirical data and are subject to criticism about their logical coherence (Bayne, 2018; Tononi, 2008). When compared to other fields of study, such as physics, for example, it seems that neuroscience is still lacking a robust theoretical framework, which is required in order to give its technique an inferential slant.

For these reasons, this thesis proposes a new conceptual model of consciousness that is called the Intrinsic Consciousness Theory by beginning with the most recent developments in the scientific description of the brain (ICT). ICT is an effort to transcend the inherent constraint of our daily language, which impacts our capacity to explain consciousness. This limitation is caused by the way language is structured. On the contrary, ICT proposes a semantic stretching of awareness, which is founded on the application of inferential reasoning to factual information. This kind of "conceptual experiment" has substantial ramifications for thinking about the ethical significance of DOCs in relation to addiction.

Chandra Bhushan Prasad*, *Department of Psychology, B.R.A. Bihar University, Muzaffarpur, India.*
E-mail: cbprasad5151@gmail.com

In addition, this contemporary philosophical theory of consciousness may have ramifications outside the scope of the theoretical setting, namely on the levels of ethics, clinical practice, and social life. In this thesis, I provide a description of particular cases from these contexts, specifically the care of people who have DOCs, the neurotechnological assessment of consciousness through computer models and simulations, and the ethics of addiction. I then conclude by outlining further possible directions that can be explored in future work. These directions include the care of people who have DOCs, the neurotechnological assessment of consciousness through computer models and simulations, and the ethics of addiction.

The expanding scientific understanding has had a tremendous influence on clinical practice, especially with respect to DOCs, and it is likely that this impact will realistically continue to expand in the future. The huge amount of scientific information that is being uncovered as a result of research into the brain is what is driving the creation of new technologies, which in turn are transforming how DOCs are seen and how they are treated.

It is important for clinicians and families to evaluate new difficulties in order to choose the most appropriate therapy for their loved ones who are afflicted with DOCs. This is because new information and technology have a substantial influence on clinical practice from an ethical standpoint.

Without first providing a conceptual definition of awareness, it is hard to provide a competent ethical appraisal of these concerns. It is important to analyze the categories used by science, its methodology, the potential biases affecting its methods and consequently its results, as well as the categories' possible theoretical impact, and the meaning of what science is studying. Such clarification is necessary to epistemically assess neuroscience as well as its extrascientific impact (e.g.consciousness). In a nutshell, even though the field of neuroscience is making progress toward a more nuanced comprehension of consciousness and the disorders that are associated with it, it is still in need of a conceptual evaluation in order to avoid falling into epistemic traps and advance from the laboratory to the clinical setting.

In addition, since there is still not a comprehensive theory of consciousness, I believe that it is appropriate to make an effort to go in this direction, based on a conversation between neuroscience and philosophy.

Chandra Bhushan Prasad*, *Department of Psychology, B.R.A. Bihar University, Muzaffarpur, India.*
E-mail: cbprasad5151@gmail.com

The development of the human brain is a dynamic process that starts in the uterus and continues notably throughout infancy, adolescence, and early adulthood. Even while hereditary factors are a significant element, environmental influences also play a significant role in the development of the brain by operating on both the cellular and the macroscopic levels. This kind of learning has an effect not just on the structure of the brain but also on its function, and it does so via types of neuronal plasticity that persist throughout our whole lives. However, despite the fact that studying brain development is undoubtedly one of the keys to appreciating how we emerge as unique human beings and how this process can go wrong in disease, our understanding of this significant period has traditionally been hampered by two main factors. One of these factors is genetics, which is the study of how genes are passed down from generation to generation.

To begin, there has been an absence of trustworthy postmortem data due to the fact that, happily, most children are healthy while they are growing up. Second, the technological limitations of previous methods such as positron emission tomography (PET) and computed tomography (CT) often imposed some modest risk of harm to the subject (for example, ionizing radiation). This rendered the study of healthy children who were typically developing unethical. The introduction of magnetic resonance imaging (MRI) technology in the 1980s brought about a significant shift in the way things were done. MRI not only produces images of the brain parenchyma that are of a higher quality than those produced by ultrasound, X-Ray, CT, or PET, but it also does so in a manner that is exceptionally risk-free for the individual being imaged.

This discussion will begin with a review of the historical postmortem and histological literature, and then move on to the ground-breaking neuroimaging investigations of the 1990s that first examined brain development using this MRI technology. The conclusion of this discussion will focus on the implications of these findings for future research. After that, a group of more specific phenomena will be investigated. These phenomena have been revealed using cutting-edge methods for brain mapping, and they have subsequently coalesced into a set of traditional characteristics that are characteristic of normal brain growth. In the end, we will bring this article to a close with a discussion of the cutting-edge efforts that are now being undertaken to integrate these varied findings into a more generic "multimodal" imaging framework, and to tie these developments to progress achieved in

Chandra Bhushan Prasad*, *Department of Psychology, B.R.A. Bihar University, Muzaffarpur, India.*
E-mail: cbprasad5151@gmail.com

cognitive development. Throughout the whole of this conversation, there will be a consistent emphasis placed on significant gender-based, geographical, and chronological differences.

Postmortem and histological studies were able to provide key insights into normal brain structure and development as well as pathology decades before the introduction of neuroimaging methods such as PET and MRI. Despite the fact that datasets were sparse, these studies were able to provide these insights. In addition, the abundant literature that was produced as a result of these early efforts has given a solid foundation of data that may be used for the validation of more recent imaging modalities. These postmortem investigations have a number of unique benefits as well as a number of significant shortcomings when compared to more current imaging methods like as MRI. Not only are the datasets relatively small in postmortem samples, as was mentioned above, but it is also impossible to conduct longitudinal studies, which are valued for their statistical power to detect changes over time within individuals amidst a population that varies greatly in its characteristics.

REVIEW LITERATURE

There is a vast amount of study on psychological time and temporal processing, mostly because of the pervasiveness of time in behavior and the importance of a temporal perspective in relation to living beings and events. This has led to the development of a broad variety of research methods. There is a huge amount of literature in social psychology regarding how behavior is shaped by time (see Perret-Clermont, 2005 or Strathman & Joireman, 2005). This literature includes topics such as time management, time perspective, and time orientation, as well as the relative value of the past and the future (Caruso, Gilbert, & Wilson, 2008; Zimbardo & Boyd 1999). Even within the realm of experimental psychology, a number of research have focused on the ways in which the chronological order of occurrences influences our perspective on the wider world (see the second part of Helfrich, 2003).

A phenomenological approach to time is one that has been taken by certain writers who are interested in consciousness (for an example, check the first section of Buccheri, Saniga, and Stuckey, 2003). Chronesthesia, also known as the awareness of subjective time (Tulving, 2002), is a relatively new branch of research that contrasts with noetic consciousness, also known as awareness of the world, and autonoetic consciousness, which refers to the awareness of one's own internal states. In recent years, time and consciousness have become

Chandra Bhushan Prasad*, *Department of Psychology, B.R.A. Bihar University, Muzaffarpur, India.*
E-mail: cbprasad5151@gmail.com

more closely linked (awareness of self in time). It is fascinating to note that there is now evidence that animals, like humans, can predict the future (Roberts, 2008).

There are a great number of psychological time studies that are connected to memory processes in a variety of ways (Block & Zakay, 2008).

One line of inquiry investigates the chronology of the events that take place in our life, in particular our recollection of the specific order in which these events took place (Damasio, 2002; Friedman, 1993).

When something happened in the past may be recalled from autobiographical memory, but that is distinct from recalling how long it lasted.

of a past occurrence or action, which will be referred to in the next paragraph as "retrospective timing." There are two primary stages involved in recalling a previous occurrence. The first method is location-based and employs the use of contextual connections in order to determine how recent the occurrences are. The second method is based on distance and requires making an estimate of the amount of time that has passed between an event in the past and the present, or the relative recency of two occurrences in the past. Another memory-related ability is called prospective memory, and it refers to the capacity to make plans and promises, to remember them, and to carry them out in the appropriate context in the future. This context may involve a time (for example, 5:00 p.m.) or a particular amount of time (for example, 5 minutes) (for time-based issues on prospective memory, see Glicksohn and Myslobodsky, 2006; Labelle, Graf, Grondin, and GagnéR Another skill that is dependent on memory is the capability to predict the amount of time that will be required to complete a job in the future (Roy and Christenfeld, 2008; Roy, Christenfeld, and McKenzie, 2005; Thomas, Handley, and Newstead, 2007).

RESEARCH METHODOLOGY

The thesis develops a conceptual analysis of the most recent empirical findings emerging from the neuroscientific investigation of consciousness. This conceptual analysis is developed within the framework of a broadly defined natural philosophy, which can be defined as an analytical conceptual approach informed by the empirical scientific data. Specifically, the first article makes an effort to develop a conceptual model of consciousness.

Chandra Bhushan Prasad*, *Department of Psychology, B.R.A. Bihar University, Muzaffarpur, India.*
E-mail: cbprasad5151@gmail.com

on the basis of new empirical findings and associated interpretation, the remaining three studies integrate conceptual and ethical analysis with the goal of applying the models created in the first research to illustrative situations (namely, DOCs and drug addiction).

The present work is developed within the methodological framework of fundamental neuroethics, which was initially introduced by Kathinka Evers (Evers, 2007, 2009) and recently developed by the Uppsala University Neuroethics group (Evers, Salles, & Farisco, 2017; Farisco, Salles, & Evers, 2018). In general, the present work is developed within this framework.

According to Evers et al. (2017), there are three primary techniques that may be used while studying neuroethics. These are neurobioethics, empirical neuroethics, and conceptual neuroethics. The primary focus of neurobioethics is on the normative aspect, which can be defined as the application of ethical theory to practical problems that arise from neuroscientific research and the clinical applications of that research, as well as problems that arise from the public communication of neuroscience research. It is generally considered that empirical neuroethics is mostly descriptive and only sometimes explanatory; it makes use of facts to evaluate both theoretical (such as the concept of moral thinking) and practical concerns (such as the definition of a moral actor). Conceptual neuroethics, including fundamental neuroethics as a particular form, is primarily theoretical in the sense that it employs conceptual analysis of key notions to assess, among other things, why and how empirical knowledge of the brain can be relevant to philosophical, social, and ethical concerns. This is true even though fundamental neuroethics is a particular form of conceptual neuroethics.

The purpose of this thesis is to make an effort to apply the conceptual neuroethics model and associated methods to the topic of consciousness specifically. Because of the constraints of the neuroscientific method, it is necessary to conduct a philosophical analysis of consciousness as a starting point for this discussion. This is not to say that neuroscience does not have a conceptual component of its own, nor is it to say that it does not have conceptual relevance. In spite of this, I believe that neuroscience is conceptually constrained in an inherently limiting way due to the following reasons (Farisco, Salles, et al., 2018): 1.

Neuroscience is a relatively new field of research, particularly when compared to other fields such as physics, which means that its conceptual component is much less developed; 2. The

Chandra Bhushan Prasad*, *Department of Psychology, B.R.A. Bihar University, Muzaffarpur, India.*
E-mail: cbprasad5151@gmail.com

possibility and the need to approach consciousness from both third- and first-person perspectives implies the epistemic insufficiency of neuroscience, which is confined to the third-person perspective; and 3. Neuroscience is necessarily linked to models, which epistemically mediate between the world and the scientific community.

The definition of these models is contingent on both scientific and non-scientific aspects, and a focused philosophical investigation may be a crucial complementation for neuroscience in order to construct the conceptual models that are the most dependable. and 4. Due to the multiscale and multilevel structure of the brain, which is organized in different spatiotemporal scales, from molecules to cells to multicellular assemblies to long-distance networks to behavior (Changeux, 2017), a conceptual work of refinement, interpretation, and synthesis is required, and neuroscience alone is not sufficient to clear all the concepts that are required (e.g. space, time, level).

The term "fundamental neuroethics" refers to a specific subfield of "conceptual neuroethics" (Evers, 2007). It aims to be not simply an analysis of the potential impact of neuroscience on fundamental notions like self, responsibility, and freedom, as was theorized in neuroethics from the beginning (Roskies, 2002), but rather an analysis of fundamental concepts and methods used in the neuroscientific investigation of notions like identity, morality, and consciousness, amongst others.

This is because it is not simply an analysis of the potential impact of neuroscience on fundamental notions like self, responsibility, and freedom. Fundamental neuroethics is both multidisciplinary and interdisciplinary in terms of its research methodology. It makes use of components from a variety of disciplines, such as philosophy of science, philosophy of language, philosophy of mind, and moral philosophy, which enables us to classify it as interdisciplinary. It is multidisciplinary since it integrates both empirical and conceptual sciences, making it impossible to categorize basic neuroethics under any one specific traditional field of study. In the end, fundamental neuroethics acknowledges the mutual relevance of philosophy and neuroscience. Philosophy, on the one hand, needs to take relevant empirical data and their interpretation into account when addressing issues such as consciousness, while neuroscience, on the other hand, needs the conceptual complementation that philosophy provides in order to explain its results.

Chandra Bhushan Prasad*, *Department of Psychology, B.R.A. Bihar University, Muzaffarpur, India.*
E-mail: cbprasad5151@gmail.com

In the context of the next debate, there is a particular component of the conceptual inadequacies of science that I believe need to be emphasized to the greatest extent possible. When the question of the nature of consciousness is at stake, the empirical technique of neuroscience, although significant, is obviously not adequate on its own.

According to what Uriah Kriegel has said, the challenge of refuting 'over-and-above' assertions, which are claims that conscious experience is nothing more than the neural basis it has, is not a scientific one but rather a philosophical one (Kriegel, Forthcoming).

The answer to the question "What is consciousness?" seems to be accessible to a lot of various interpretations, according to the results of neuroscientific research such as NCC. An in-depth conceptual investigation with a specific emphasis might lend credence to a certain point of view. Because of this, philosophical thought on consciousness cannot be considered an optional supplement to the study of consciousness in neuroscience; rather, it must be considered an essential component of this study.

DATA ANALYSIS

INTRODUCTION

Abuse of methamphetamine (MA) is a significant medical and social problem worldwide, with broadening use and manufacture in developing regions of Southeast Asia and Oceania (McKetin et al., 2008), and continued prevalence in established centers like Japan, Taiwan, Hawaii, and the southwest mainland of the United States of America. Methamphetamine abuse is a global problem that affects people on a medical and social level (Maxwell and Rutkowski, 2008; SAMHSA 2008). Surprisingly little is known about the effects of prenatal exposure to methamphetamine (MA) on the developing brain (Thompson et al., 2009). See Roussotte et al. (2010) for a review of the available evidence. Methamphetamine use in adults has been clearly linked to broad negative effects on the central nervous system, as well as negative social outcomes and effects on other organ systems (McCann et al., 1998; Thompson e Recently, a large prospective study has demonstrated fetal growth restriction in the context of prenatal exposure to MA.

Additionally, the study has expanded observations of poorer neurobehavioral outcomes to include depressed arousal and movement scores, as well as higher levels of stress in newborn infants (age 2.0 1.6 days) (Lagasse et al., 2011; Nguyen et al., 2010; Smith et al., 2008,

Chandra Bhushan Prasad*, *Department of Psychology, B.R.A. Bihar University, Muzaffarpur, India.*
E-mail: cbprasad5151@gmail.com

2006a). The very first neuroimaging experiment to exclusively address prenatal exposure to MA employed [1H] proton magnetic resonance spectroscopy (MRS) to report results that were indicative of metabolic abnormalities in the striata of exposed children (age 8.1 0.8 years) (Smith et al., 2001). This was then followed by a volumetric analysis using magnetic resonance imaging (MRI), which revealed smaller subcortical volumes in the basal ganglia and hippocampi of affected children, as well as correlations between brain volumes and poorer performance on attention and verbal memory tests (age 6.93.5 years) (Chang et al., 2004).

These results were published in the journal Neurology. Recent evidence from functional magnetic resonance imaging (fMRI) in children who were exposed to methamphetamine during pregnancy also suggests abnormal patterns of brain activation. These patterns include more diffuse brain activation during a verbal working memory task (age 9.5 1.9 years) (Lu et al., 2009), as well as lower frontostriatal activation during a visual working memory task (age 9.2 1.8 years) (Roussotte et al., 2011). The only reports of white matter abnormalities that have been published are from a region-of-interest dif42 fusion imaging study. This study examined MA-exposed children who were 3 and 4 years old and found lower diffusion in frontal and parietal areas, as well as a trend towards greater diffusion fractional anisotropy (FA) in the left frontal white matter of the exposed group (Cloak et al., 2009). In a sample that overlapped, 1H-MRS found increased metabolite concentrations (total creatinine, N-acetyl compounds, glutamate/glutamine) in the white matter of the frontal lobe (Chang et al., 2009). When considered as a whole, the behavioral changes seen in infants as well as the imaging findings in children's brains imply that prenatal exposure to MA has a deleterious influence on the development of the brain. However, it is difficult to draw conclusive statements on the particular effects of MA since this group is often exposed to many drugs.

Because alcohol is a recognized teratogen (Jones et al., 1973) and because it has been found to generate long-lasting clinical impairments, concurrent prenatal exposure to alcohol is a particularly worrying issue (Spohr et al., 2007).

In addition to this, studies have revealed that over half of the pregnant women who use MA also consume alcohol throughout their pregnancies (Smith et al., 2006a). Children who were exposed to high levels of alcohol during pregnancy had global, regional, and subcortical volumetric abnormalities on neuroimaging studies, in addition to cortical thickness and

Chandra Bhushan Prasad*, *Department of Psychology, B.R.A. Bihar University, Muzaffarpur, India.*
E-mail: cbprasad5151@gmail.com

functional magnetic resonance imaging (fMRI) abnormalities (Coles and Li, 2011; Lebel et al., 2011). Children who were exposed to high levels of alcohol during pregnancy have been shown to have a range of white matter abnormalities, the most notable of which are dramatic malformations of the corpus callosum. This is the part of the study that is most pertinent to our current research (Sowell et al., 2010; Wozniak and Muetzel, 2011).

Using whole-brain diffusion tensor imaging, the purpose of this research was to investigate the effects of prenatal methamphetamine exposure on the architecture of white matter (DTI). DTI is able to give an indirect noninvasive evaluation of white matter microarchitecture in vivo because it measures the diffusion characteristics of water within the brain. These qualities are impacted by the limitations put on them by the neuronal microenvironment. We anticipated finding anomalies in the areas of the white matter tracts that link striatal with cortical structures given the effect that MA use has been shown to have on striatal structures in adult substance abusers, as well as the minimal evidence that has been found in children. We expected to find a similar pattern in our older sample of children on tests of executive function (Trails B), visuomotor integration (VMI), and whole-brain FA maps. This is because there have been reports of deficits in executive measures of attention, deficits in visual motor integration (Chang et al., 2004), and findings of higher diffusion anisotropy in frontal white matter in children with prenatal MA exposure (Cloak et al., 2009). In spite of these hypothesized differences between groups, we still expected regionally-specific relationships between FA and performance within groups, such that higher FA (an indicator of white matter fiber organization) in the frontal lobe would be associated with better performance (more efficient processing) on a test of executive function (Trails B), but not on a test of visuomotor integration (VMI), and, conversely, that higher FA in the parietal lobe would be associated with better performance (more efficient processing

METHODS

PARTICIPANTS

According on their level of exposure, participants were divided into the following three groups: 1) Subjects who had been exposed to methamphetamine (MA, n = 21), 2) Subjects who had been exposed to alcohol (ALC, n = 19), and 3) Subjects who had developed normally (CON, n = 27). Subjects were included in the MA group if it was reported by a parent or guardian that they had been exposed to methamphetamine or if it was documented

Chandra Bhushan Prasad*, *Department of Psychology, B.R.A. Bihar University, Muzaffarpur, India.*
E-mail: cbprasad5151@gmail.com

in maternal or baby medical records. Participants were included in the ALC group if they had exposure to 4 drinks on any occasion or were exposed to 14 drinks in any week during the pregnancy (a "drink" is defined as a 12 oz. beer, 4 oz. glass of wine, or cocktail with 1 shot of liquor), and they had no methamphetamine exposure. This is in line with previous research on fetal alcohol spectrum disorders (FASDs), which acknowledges the impact of both frequent drinking and less frequent (Hoyme et al., 2005).

Exclusion criteria for phone screening that apply to all of the categories included: 1) age younger than 5 years; we were most interested in the long-lasting effects of MA, and additionally, available staff were only trained on this age range for neuropsychological testing; 2) IQ less than 70; 3) head injury with loss of consciousness for over 20 minutes; 4) physical (e.g. hemiparesis) or psychiatric illness, or developmental disability (e.g. autism); and 5) no milder head injuries were reported on a follow-up parent self-report The majority of the participants in the ALC study came from a social skills training program affiliated with a university44 that was designed for children with FASDs. After it was discovered that some of the FASD subjects' mothers had also abused MA while they were pregnant, subjects for the MA group were recruited from the same social skills group as those for the FASD subjects, as well as from self-referral and word-of-mouth, as well as from the first two sources. Subjects in the MA group were observed to have a higher risk of developing FASD than FASD subjects who were observed to have a higher risk of developing FASD. CON individuals were recruited from the same neighborhoods in Los Angeles as the exposed groups, and efforts were made to recruit from comparable socioeconomic level (SES) strata. This was done in order to compare the two sets of results (e.g. advertisements targeted to zip codes with similar SES as our exposed subjects).

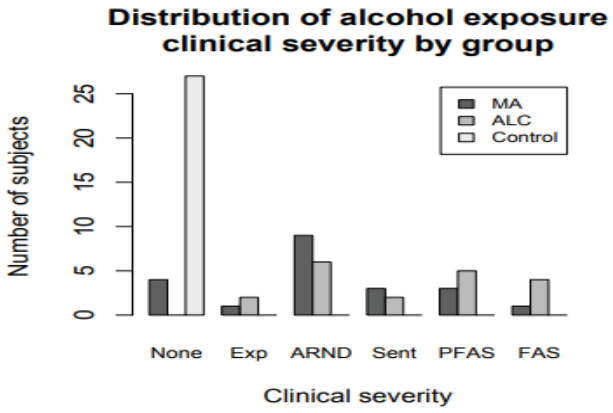
In a separate article (O'Connor et al., 2006), the diagnostic techniques for fetal alcohol spectrum disorders that were utilized to categorize the patients of the ALC and MA studies were explained in more detail. In a nutshell, a seasoned medical professional used the Diagnostic Guide for Fetal Alcohol Syndrome (FAS) and Related Conditions to conduct an evaluation on youngsters who had been exposed to alcohol (Astley, 2004). This approach utilizes a four-digit diagnostic code that reflects the degree to which each of the following four essential diagnostic aspects of FAS are expressed: 1) a failure to meet development expectations; 2) the FAS facial phenotype, which is characterized by small palpebral fissures, a flat philtrum, and a thin upper lip; 3) malfunction of the central nervous system; and 4)

Chandra Bhushan Prasad*, *Department of Psychology, B.R.A. Bihar University, Muzaffarpur, India.*
E-mail: cbprasad5151@gmail.com

exposure to alcohol during pregnancy. Children who had been exposed to alcohol (with or without concurrent MA exposure) were given a diagnosis of fetal alcohol syndrome (FAS), partial FAS, sentinel characteristics, or alcohol-related neurodevelopmental disorder (ARND) based on these criteria (Figure 2.1). Consent from parents or guardians and agreement from study participants were both gained after a thorough explanation of the research project's methodology by the University of California, Los Angeles (UCLA) Institutional Review Board (IRB) in line with the protocols established by the IRB.

4.2.2 Neuropsychological Testing

The participants were put through a comprehensive battery of neuropsychological tests, which were performed by professional full-time personnel who were blinded to the participants' exposure status. Measures of general intelligence (prorated full-scale IQ) (Wechsler, 2003), visuomotor integration (VMI), and executive control were included of the battery of examinations that were administered (Trail Making Test). Subjects are given instructions to draw a sequence of geometric objects that are shown visually during the VMI exam. As a result, performance on the test reflects intact visual sensory input, motor output, and the integration of these three components (Beery, 1997). A well-known composite metric is known as the Trail Making Test.



Alcohol Exposure Clinical Severity By Group. Exp = Exposed (Least Severe), ARND = Alcohol-Related Neurodevelopmental Disorder, Sent = Sentinel (Shows Mild Facial Dysmorphology), PFAS = Partial FAS, FAS = Fetal Alcohol Syndrome (Most Severe). MA = Methamphetamine-Exposed Group, ALC = Alcohol-Exposed Group.

of executive function, and Part B, in which the respondent is required to quickly link ringed letters and numbers that have been irregularly arranged on a piece of paper, has been

Chandra Bhushan Prasad*, *Department of Psychology, B.R.A. Bihar University, Muzaffarpur, India.*
E-mail: cbprasad5151@gmail.com

demonstrated to be especially sensitive to cognitive flexibility. [Citation needed] (Kortte et al., 2002).

CONCLUSION

A conceptual study of current results in neuroscientific research demonstrates the validity of a monistic view of consciousness, which is viewed of as an overarching notion embracing both aware and unconscious brain activities. This perspective is supported by the evidence. Accordingly, ICT considers consciousness to be an inherent quality of the brain. According to this theory, one must inevitably be aware, even if just on the most fundamental levels, provided one's brain maintains the right intrinsic and resting state activities. This method, despite the fact that it is controversial, has the potential to offer a fresh impetus to the scientific investigation on consciousness and to bring new insights for the ethical evaluation of connected concerns, including the treatment of DOCs and addiction.

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Chandra Bhushan Prasad*, *Department of Psychology, B.R.A. Bihar University, Muzaffarpur, India.*
E-mail: cbprasad5151@gmail.com

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Chandra Bhushan Prasad*, *Department of Psychology, B.R.A. Bihar University, Muzaffarpur, India.*
E-mail: cbprasad5151@gmail.com