CEREBRAL PSYCHOPHYSIOLOGY pdf

1: Cerebral psychophysiology: studies in event-related potentials.

The International Journal of Psychophysiology is the official journal of the International Organization of Psychophysiology, and provides a respected forum for the publication of high quality original contributions on all aspects of psychophysiology.

This section does not cite any sources. Please help improve this section by adding citations to reliable sources. Unsourced material may be challenged and removed. August Learn how and when to remove this template message Some people have difficulty distinguishing a psychophysiologist from a physiological psychologist , two very different perspectives. A psychophysiologist will attempt to link the two. While early psychophysiologists almost always examined the impact of psychological states on physiological system responses, since the s, psychophysiologists also frequently study the impact of physiological states and systems on psychological states and processes. It is this perspective of studying the interface of mind and body that makes psychophysiologists most distinct. Historically, most psychophysiologists tended to examine the physiological responses and organ systems innervated by the autonomic nervous system. More recently, psychophysiologists have been equally, or potentially more, interested in the central nervous system , exploring cortical brain potentials such as the many types of event-related potentials ERPs , brain waves, and utilizing advanced technology such as functional magnetic resonance imaging fMRI , MRI , PET , MEG, and other neuroimagery techniques. A physiological psychologist may look at how one cardiovascular event may influence another cardiovascular or endocrine event, or how activation of one neural brain structure exerts excitatory activity in another neural structure which then induces an inhibitory effect in some other system. Often, physiological psychologists examine the effects that they study in infrahuman subjects using surgical or invasive techniques and processes. Psychophysiology is closely related to the field of neuroscience and social neuroscience , which primarily concerns itself with relationships between psychological events and brain responses. Psychophysiology is also related to the medical discipline known as psychosomatics. While psychophysiology was a discipline off the mainstream of psychological and medical science prior to roughly the and s, more recently, psychophysiology has found itself positioned at the intersection of psychological and medical science, and its popularity and importance have expanded commensurately with the realization of the inter-relatedness of mind and body. Measures[edit] Psychophysiology measures exist in three domains; reports, readings, and behavior. Many indices are part of modern psychophysiology, including brain waves electroencephalography, EEG , fMRI functional magnetic resonance imaging , electrodermal activity a standardized term encompassing skin conductance response, SCR, and galvanic skin response, GSR , cardiovascular measures heart rate , HR; beats per minute , BPM; heart rate variability , HRV; vasomotor activity , muscle activity electromyography , EMG , electrogastrogram EGG changes in pupil diameter with thought and emotion pupillometry , eye movements, recorded via the electro-oculogram EOG and direction-of-gaze methods, and cardiodynamics, recorded via impedance cardiography. These measures are beneficial because they provide accurate and perceiver-independent objective data recorded by machinery. These are good response measures and easy to record in animals, but they are not as frequently used in human studies. Physiological sensors have been used to detect emotions in schools [7] and intelligent tutoring systems. For example, anger might be constituted by a certain set of physiological responses, such as increased cardiac output and high diastolic blood pressure, which would allow us to better understand patterns and predict emotional responses. Some studies were able to detect consistent patterns of ANS responses that corresponded to specific emotions under certain contexts, like an early study by Paul Ekman and colleagues in "Emotion-specific activity in the autonomic nervous system was generated by constructing facial prototypes of emotion muscle by muscle and by reliving past emotional experiences. The autonomic activity produced distinguished not only between positive and negative emotions, but also among negative emotions". However it was also found that features of the participant could also alter ANS responses. Factors such as basal level of arousal at the time of experimentation or between test recovery, learned or conditioned responses to certain stimuli, range and maximal level of effect of ANS action, and individual attentiveness can all alter

physiological responses in a lab setting. For example, some emotional typologists consider fear to have subtypes, which might involve fleeing or freezing, both of which can have distinct physiological patterns and potentially distinct neural circuitry. Psychophysiological inference and physiological computer games[edit] Physiological computing represents a category of affective computing that incorporates real-time software adaption to the psychophysiological activity of the user. The main goal of this is to build a computer that responds to user emotion, cognition and motivation. There are several possible methods to represent the psychological state of the user discussed in the affective computing page. The advantages of using psychophysiological indices are that their changes are continuous, measures are covert and implicit, and only available data source when the user interacts with the computer without any explicit communication or input device. These systems rely upon an assumption that the psychophysiological measure is an accurate one-to-one representation of a relevant psychological dimension such as mental effort, task engagement and frustration. Physiological computing systems all contain an element that may be termed as an adaptive controller that may be used to represent the player. This adaptive controller represents the decision-making process underlying software adaptation. In their simplest form, adaptive controllers are expressed in Boolean statements. Adaptive controllers encompass not only the decision-making rules, but also the psychophysiological inference that is implicit in the quantification of those trigger points used to activate the rules. The representation of the player using an adaptive controller can become very complex and often only one-dimensional. The loop used to describe this process is known as the biocybernetic loop. The biocybernetic loop describes the closed loop system that receives psychophysiological data from the player, transforms that data into a computerized response, which then shapes the future psychophysiological response from the player. A positive control loop tends towards instability as player-software loop strives towards a higher standard of desirable performance. The physiological computer game may wish to incorporate both positive and negative loops into the adaptive controller.

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2: Modern mind-brain reading: psychophysiology, physiology, and cognition.

Since there has been a resurgence of interest in multiple personality disorder including sophisticated studies of physical symptoms, brain-wave activity, visual evoked potential, regional cerebral blood flow, visual refraction, muscle activity, cardiac and respiratory activity, galvanic skin response, and the switch process.

Learn what qualifies as psychophysiology within the broader field of neuroscience. Review and compare several examples of psychophysiological methods. Understand advantages and disadvantages of different psychophysiological methods. History In the midth century, a railroad worker named Phineas Gage was in charge of setting explosive charges for blasting through rock in order to prepare a path for railroad tracks. He would lay the charge in a hole drilled into the rock, place a fuse and sand on top of the charge, and pack it all down using a tamping iron a solid iron rod approximately one yard long and a little over an inch in diameter. On a September afternoon when Gage was performing this task, his tamping iron caused a spark that set off the explosive prematurely, sending the tamping iron flying through the air. Gage lost a portion of his left frontal lobe in the accident, but survived and lived for another 12 years. He became more impulsive, he had trouble carrying out plans, and, at times, he engaged in vulgar profanity, which was out of character. This case study leads one to believe that there are specific areas of the brain that are associated with certain psychological phenomena. When studying psychology, the brain is indeed an interesting source of information. Although it would be impossible to replicate the type of damage done to Gage in the name of research, methods have developed over the years that are able to safely measure different aspects of nervous system activity in order to help researchers better understand psychology as well as the relationship between psychology and biology. Introduction Psychophysiology is defined as any research in which the dependent variable what the researcher measures is a physiological measure, and the independent variable what the researcher manipulates is behavioral or mental. In most cases the work is done noninvasively with awake human participants. Physiological measures take many forms and range from blood flow or neural activity in the brain to heart rate variability and eye movements. These measures can provide information about processes including emotion, cognition, and the interactions between them. In these ways, physiological measures offer a very flexible set of tools for researchers to answer questions about behavior, cognition, and health. Psychophysiological methods are a subset of the very large domain of neuroscience methods. Many neuroscience methods are invasive , such as involving lesions of neural tissue, injection of neutrally active chemicals, or manipulation of neural activity via electrical stimulation. The present survey emphasizes noninvasive methods widely used with human subjects. Crucially, in examining the relationship between physiology and overt behavior or mental events, psychophysiology does not attempt to replace the latter with the former. As an example, happiness is a state of pleasurable contentment and is associated with various physiological measures, but one would not say that those physiological measures are happiness. Sometimes our interest is primarily in inferences about internal events and sometimes primarily in the physiology itself. Psychophysiology addresses both kinds of goals. Each method can draw from a broad range of data-analysis strategies to provide an even more expansive set of tools. The psychophysiological methods discussed below focus on the central nervous system. Structural magnetic resonance imaging sMRI is a noninvasive technique that allows researchers and clinicians to view anatomical structures within a human. The body is then pulsed with low-energy radio frequencies that are absorbed by the atoms in the body, causing them to tip over. As these atoms return to their aligned state, they give off energy in the form of harmless electromagnetic radiation, which is measured by the machine. The machine then transforms the measured energy into a three-dimensional picture of the tissue within the body. In psychophysiology research, this image may be used to compare the size of structures in different groups of people e. Functional magnetic resonance imaging fMRI is a method that is used to assess changes in activity of tissue, such as measuring changes in neural activity in different areas of the brain during thought. This technique builds on the principles of sMRI and also uses the property that, when neurons fire, they use energy, which must be replenished. Glucose and oxygen, two key components for energy production, are supplied to the brain from the blood stream as needed. Oxygen is

transported through the blood using hemoglobin , which contains binding sites for oxygen. When these sites are saturated with oxygen, it is referred to as oxygenated hemoglobin. When the oxygen molecules have all been released from a hemoglobin molecule, it is known as deoxygenated hemoglobin. As a set of neurons begin firing, oxygen in the blood surrounding those neurons is consumed, leading to a reduction in oxygenated hemoglobin. The body then compensates and provides an abundance of oxygenated hemoglobin in the blood surrounding that activated neural tissue. When activity in that neural tissue declines, the level of oxygenated hemoglobin slowly returns to its original level, which typically takes several seconds. This leads to two important facts about fMRI. First, fMRI measures blood volume and blood flow, and from this we infer neural activity; fMRI does not measure neural activity directly. Second, fMRI data typically have poor temporal resolution the precision of measurement with respect to time ; however, when combined with sMRI, fMRI provides excellent spatial resolution the ability to distinguish one object from another in space. Temporal resolution for fMRI is typically on the order of seconds, whereas its spatial resolution is on the order of millimeters. Under most conditions there is an inverse relationship between temporal and spatial resolutionâ€”one can increase temporal resolution at the expense of spatial resolution and vice versa. This method is valuable for identifying specific areas of the brain that are associated with different physical or psychological tasks. Clinically, fMRI may be used prior to neurosurgery in order to identify areas that are associated with language so that the surgeon can avoid those areas during the operation. For example, if participants are shown words on a screen and are expected to indicate the color of the letters, are the same brain areas recruited for this task if the words have emotional content or not? Does this relationship change in psychological disorders such as anxiety or depression? Is there a different pattern of activation even in the absence of overt performance differences? The blue and orange shapes represent areas with significant changes in the BOLD signal, thus changes in neural activation. We infer that neural activity increased in the Area 1 and decreased in Area 2. Electroencephalography EEG is another technique for studying brain activation. This technique uses at least two and sometimes up to electrodes to measure the difference in electrical charge the voltage between pairs of points on the head. From the scalp, the electrodes measure the electrical activity that is naturally occurring within the brain. They do not introduce any new electrical activity. Electrodes used in EEG can also be placed within the skull, resting directly on the brain itself. This application, called electrocorticography ECoG , is typically used prior to medical procedures for localizing activity, such as the origin of epileptic seizures. This invasive procedure allows for more precise localization of neural activity, which is essential in medical applications. Given that this electrical activity must travel through the skull and scalp before reaching the electrodes, localization of activity is less precise when measuring from the scalp, but it can still be within several millimeters when localizing activity that is near the scalp. One major advantage of EEG is its temporal resolution. Data can be recorded thousands of times per second, allowing researchers to document events that happen in less than a millisecond. EEG analyses typically investigate the change in amplitude or frequency components of the recorded EEG on an ongoing basis or averaged over dozens of trials see Figure 2. Example of EEG analysis output. Panel A represents changes in the relative strength of different frequencies in the EEG data over time. Panel B represents changes in the amplitude in the instantaneous EEG voltage over time. Magnetoencephalography MEG is another technique for noninvasively measuring neural activity. The number of sensors used varies from a few to several hundred. Due to the fact that the magnetic fields of interest are so small, special rooms that are shielded from magnetic fields in the environment are needed in order to avoid contamination of the signal being measured. Additionally, MEG is not as susceptible to distortions from the skull and scalp. Magnetic fields are able to pass through the hard and soft tissue relatively unchanged, thus providing better spatial resolution than EEG. For example, if someone is reading a sentence that ends with an unexpected word e. This allows for a better understanding of brain networks, such as their role in different tasks and how they may function abnormally in psychopathology. Positron emission tomography PET is a medical imaging technique that is used to measure processes in the body, including the brain. This method relies on a positron-emitting tracer atom that is introduced into the blood stream in a biologically active molecule, such as glucose, water, or ammonia. A positron is a particle much like an electron but with a positive charge. One example of a

biologically active molecule is fludeoxyglucose, which acts similarly to glucose in the body. Fludeoxyglucose will concentrate in areas where glucose is neededâ€”commonly areas with higher metabolic needs. Over time, this tracer molecule emits positrons, which are detected by a sensor. The spatial location of the tracer molecule in the brain can be determined based on the emitted positrons. This allows researchers to construct a three-dimensional image of the areas of the brain that have the highest metabolic needs, typically those that are most active. Images resulting from PET usually represent neural activity that has occurred over tens of minutes, which is very poor temporal resolution for some purposes. PET images are often combined with computed tomography CT images to improve spatial resolution, as fine as several millimeters. Tracers can also be incorporated into molecules that bind to neurotransmitter receptors, which allow researchers to answer some unique questions about the action of neurotransmitters. Unfortunately, very few research centers have the equipment required to obtain the images or the special equipment needed to create the positron-emitting tracer molecules, which typically need to be produced on site. Transcranial magnetic stimulation TMS is a noninvasive method that causes depolarization or hyperpolarization in neurons near the scalp. This method is not considered psychophysiological because the independent variable is physiological, rather than the dependent. However, it does qualify as a neuroscience method because it deals with the function of the nervous system, and it can readily be combined with conventional psychophysiological methods. When electricity flows through the coil, it produces a magnetic field. This magnetic field travels through the skull and scalp and affects neurons near the surface of the brain. When the magnetic field is rapidly turned on and off, a current is induced in the neurons, leading to depolarization or hyperpolarization, depending on the number of magnetic field pulses. Single- or paired-pulse TMS depolarizes site-specific neurons in the cortex, causing them to fire. If this method is used over primary motor cortex, it can produce or block muscle activity, such as inducing a finger twitch or preventing someone from pressing a button. If used over primary visual cortex, it can produce sensations of flashes of light or impair visual processes. This has proved to be a valuable tool in studying the function and timing of specific processes such as the recognition of visual stimuli. Repetitive TMS produces effects that last longer than the initial stimulation. Depending on the intensity, coil orientation, and frequency, neural activity in the stimulated area may be either attenuated or amplified. Used in this manner, TMS is able to explore neural plasticity , which is the ability of connections between neurons to change. This has implications for treating psychological disorders as well as understanding long-term changes in neuronal excitability. Peripheral Nervous System The psychophysiological methods discussed above focus on the central nervous system.

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3: J R Jennings, PhD | University of Pittsburgh Department of Psychiatry

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1. Electroencephalogr Clin Neurophysiol Suppl. ; Cerebral psychophysiology: studies in event-related potentials. [No authors listed].

6: Psychophysiology - Wikipedia

This study examined individual differences in visceral perception as a function of cerebral lateral preference as assessed by conjugate lateral eye movements. Subjects were classified as "left movers" (i.e., right hemisphere preferent) or "right movers" (i.e., left hemisphere preferent).

7: International Organization of Psychophysiology - Journal

1 Stress Psychophysiology Chapter 2 Introduction â€¢ This chapter covers the process & structures activated during the physiological response to stress.

8: Papers | Behavioral Neurophysiology Lab | University of Pittsburgh

â€¢ Cerebral psychophysiology: including functional brain mapping and neuroimaging with Event- Related Potentials (ERPs), Positron Emission Tomography (PET), Functional Magnetic Resonance Imaging (fMRI) and Electroencephalographic studies.

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