

## Acute effects of caffeine on selective attention and visual search processes

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### Abstract

The influence of a single dose of caffeine was evaluated in focused and divided attention conditions of a visual selective search task in which subjects had to perform controlled search processes to locate a target item. Search processes were manipulated by varying display load. A dose of 3 mg/kg body weight caffeine or lactose, dissolved in a cup of decaffeinated coffee, was administered double blindly and deceptively to overnight abstinent coffee drinkers. Behavioral measures were supplemented by event-related potentials (ERPs). Subjects reacted faster in the caffeine condition. The P3b peak latency decreased after caffeine in the low display load condition and in the focused attention condition, indicating that the effects of caffeine are dependent on the number of relevant display items, not on the total number of display items presented. Search processes, as reflected in a negative ERP deflection, were not affected by caffeine.

**Descriptors:** Caffeine, Focused attention, Divided attention, Display load, Visual event-related potentials

In situations such as driving a car, there are many sources of information in the environment that have to be attended to to drive safely. In the optimal situation, subjects are able to pay attention to all information at the same time. However, the human information processing system is limited in its processing capacity and can only process a restricted amount of information at the same time. Therefore, one has to select relevant cues in the environment to attend to at appropriate times to perform optimally. Performance failures can be made easily if attention is distracted by irrelevant information.

Two types of selective attention can be discerned. In a *focused attention* condition, subjects have to concentrate on one source of information; for example, a conversation in which one is involved. The *divided attention* condition is defined as a situation in which attention has to be divided over a number of stimuli. An example of the latter situation is the automobile driver who has to attend to the road signs while maintaining control of the car.

Experimental evidence indicates that increases in arousal tend to restrict the focus of attention (Humphreys & Revelle, 1984; Posner & Raichle, 1994) and thus might prevent people from being distracted by irrelevant information. In accordance with this, Lorist and colleagues (Lorist, Snel, Kok, & Mulder, 1994; Lorist, Snel, Mulder, & Kok, 1995) found that subjects seemed

to be less distracted by irrelevant information after they used caffeine, which is regarded as a stimulant. They used a focused attention version of a selective search task (Okita, Wijers, Mulder, & Mulder, 1985; Shiffrin & Schneider, 1977; Schneider & Shiffrin, 1977; Wijers et al., 1987) in which subjects had to detect the possible occurrence of a memory set item presented on relevant diagonal positions of the display and to ignore stimuli appearing at the irrelevant diagonal. Different computational processes are involved in the task. First, subjects have to discriminate between relevant and irrelevant information, followed by a comparison of the selected information to internal representations. Thereafter, a response decision should be made, and, subsequently, this response has to be selected, programmed, and executed (see also Mulder, Wijers, Lange, Smid, & Gunter, 1993). Information transformations related to the encoding of incoming information, that is, to the identification of incoming information, are supposed to be input-related processes. Memory search and response decision are regarded as central processes involved in the further processing of information. The preparation, activation, and execution of responses are assumed to represent output mechanisms associated with the organization of motor-related activities.

These different mental operations are assumed to be reflected in various components of the event-related brain potential (ERP). The selection between relevant and irrelevant information can be observed by superimposing the ERPs elicited by attended and unattended stimuli. Previous studies have indicated that these two waveforms start to diverge at 260 ms, with a maximum at frontocentral scalp positions, independent of whether subjects had caffeine or placebo. However, the amplitude of this

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# Effects Of Caffeine On Visual Attention

**Annette Kujawski Taylor Ph.D.**



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**Using Substances to Enhance Performance: A Psychology of Neuroenhancement** Ralf Brand, 2017-01-18 Neuroenhancement NE is a behavior conceptualized as the use of a potentially psychoactive substance to enhance ones already proficient cognitive capacities Depending on the specific definitions used prevalence estimates vary greatly between very low 0 3% for illicit substances to astonishingly high 89% for freely available lifestyle substances These variations indicate that further research and more conceptual and theoretical clarification of the NE construct is dearly needed The contributions of this research topic aim to do just that Specific questions addressed are How prevalent is NE behavior How can NE research profit from the already more evolved field of social science research on doping in sports How is NE perceived by the public What psychological processes and variables play a role in the decision to neuroenhance A wide array of methodological approaches is used to investigate these questions The topics contributions range from theoretical to experimental accounts on NE and they utilize a diverse set of methods ranging from qualitative to neuroscientific approaches The research presented here represents a first step towards what we have labeled a psychological approach to NE By addressing the questions above this research topic hopefully advances our understanding of NE behavior As with every new field of research new answers always prompt new questions In light of what we know now about NE we hope that the findings presented here will be pursued by other researchers in the future Clearly the endeavor to understand NE behavior has only just begun

**Caffeine and Behavior: Current Views & Research Trends** B.S. Gupta, Uma Gupta, 2020-03-05 The psychobehavioral effects of caffeine on humans is analyzed in this book from an experimental approach Caffeine and Behavior Current Views and Research Trends is unique in its emphasis on empirical research and its

inclusion of articles concerning the addictive potential of caffeine Topics covered include addiction neurotransmission

*Attention, Arousal and the Orientation Reaction* R. Lynn, 2013-09-11 *Attention Arousal and the Orientation Reaction* aims to present in a volume the works of Pavlov an eminent Russian physiologist known for his contributions specifically the classical conditioning This book contains the interpretations and theories in physiological terms and elaborates on the neurological models of significant interest The orientation reaction is described and the Sokolov s model which is claimed to be the most comprehensive model for the orientation reaction is then illustrated This text also explains the phenomenon of habituation wherein facts involved are summarized in a chapter A discussion on the numerous neurological models of the habituation process is then given This text notes that the models are divided into one stage models and two stage models Other topics presented are the effects of transforming a neutral stimulus into a conditioned stimulus the orientation reaction in ontogenetic and phylogenetic development and the orientation reaction in the measurement of individual differences This book will be beneficial to those fascinated with the works of Pavlov especially the psychology students and practitioners

**Cumulated Index Medicus** ,1996 Hemispheric Bases for Emotion and Memory Tad T. Brunye, Sarah R. Cavanagh, Ruth E. Propper, 2015-06-01 It has become clear that the two halves of the cortex differ in their contributions to both affective and memory processes Still the exact nature of the interrelationships among hemispheric function emotion and memory remains elusive For example controversy remains regarding differential hemispheric involvement in emotion motivation and affective style Regarding memory although evidence suggests differences in the manner in which the hemispheres interact may be related to memory retrieval it is still not certain which factors involved in retrieval encourage or inhibit hemispheric communication The goal of this Research Topic was to bring together diverse scientific perspectives on lateralized brain mechanisms underlying emotion motivation and memory A range of international experts with diverse backgrounds theoretical perspectives and experimental methods contributed to the Topic These contributions inform our understanding of lateralized affective and cognitive processes by providing thorough reviews of our current state of knowledge based on previous literature by sharing intriguing new empirical findings and by proposing theoretical models with testable frameworks to stimulate future research **Coffee and Caffeine Consumption for Human Health** Juan Del Coso, 2020-04-15 The year 2019 has been prolific in terms of new evidence regarding the effects of coffee and caffeine consumption on diverse aspects of human functioning This book collects 20 high quality manuscripts published in *Nutrients* that include original investigation or systematic review studies of the effects of caffeine intake on human performance and health The diversity of the articles published in this Special Issue highlights the extent of the effects of coffee and caffeine on human functioning while underpinning the positive nature of most of these effects This book will help with understanding why the natural sources of caffeine are so widely present in the nutrition behaviors of modern society *Coffee, Tea, Chocolate, and the Brain* Astrid Nehlig, 2004-04-27 Coffee tea and chocolate are among the most frequently consumed

products in the world The pleasure that many experience from these edibles is accompanied by a range of favorable and adverse effects on the brain that have been the focus of a wealth of recent research Coffee Tea Chocolate and the Brain presents new information on the *Placebo and Nocebo Effects in Psychiatry and Beyond* Paul Enck, Katja Weimer, Luana Colloca, Seetal Dodd, 2020-10-08 This eBook is a collection of articles from a Frontiers Research Topic Frontiers Research Topics are very popular trademarks of the Frontiers Journals Series they are collections of at least ten articles all centered on a particular subject With their unique mix of varied contributions from Original Research to Review Articles Frontiers Research Topics unify the most influential researchers the latest key findings and historical advances in a hot research area Find out more on how to host your own Frontiers Research Topic or contribute to one as an author by contacting the Frontiers Editorial Office [frontiersin.org](mailto:frontiersin.org) about contact *Diet, Brain, Behavior* Robin B. Kanarek, Harris R. Lieberman, 2011-10-06 As the field of nutritional neuroscience has grown both the scientific community and the general population have expressed a heightened interest in the effect of nutrients on behavior *Diet Brain Behavior Practical Implications* presents the work of a diverse group of scientists who collectively explore the broad scope of research in the field T *Nutrigenetics* Dolores Corella, 2018-07-10 This book is a printed edition of the Special Issue Nutrigenetics that was published in *Nutrients* **Index Medicus**, 2004 Vols for 1963 include as pt 2 of the Jan issue Medical subject headings *Human Sleep and Cognition* G. A. Kerkhof, Hans P. A. Van Dongen, 2010 *The Attentive Brain* Raja Parasuraman, 2000 Of the myriad tasks that the brain has to perform perhaps none is as crucial to the performance of other tasks as attention A central thesis of this book on the cognitive neuroscience of attention is that attention is not a single entity but a finite set of brain processes that interact mutually and with other brain processes in the performance of perceptual cognitive and motor skills After an introductory part I the book consists of three parts Part II Methods describes the major neuroscience methods including techniques used only with animals anatomical tract tracing single unit electrophysiology neurochemical manipulations noninvasive human brain imaging techniques ERPs positron emission tomography and functional magnetic resonance imaging and studies with brain damaged individuals This part also includes a chapter on the computational modeling of attention Part III Varieties of Attention looks at three major components of attention from the cognitive neuroscience perspective selection vigilance and control It also discusses links to memory and language Finally part IV Development and Pathologies discusses the application of findings from the previous sections to the analysis of normal and abnormal development and to pathologies of attention such as schizophrenia and attention deficit disorders Contributors Edward Awh Gordon C Baylis Jochen Braun Dennis Cantwell Vincent P Clark Maurizio Corbetta Susan M Courtney Francis Crinella Matthew C Davidson Gregory J DiGirolamo Jon Driver Jane Emerson Pauline Filipek Ira Fischler Massimo Girelli Pamela M Greenwood James V Haxby Mark H Johnson John Jonides Julian S Joseph Robert T Knight Christof Koch Steven J Luck Richard T Marrocco Brad C Motter Ken Nakayama Orhan Nalcioglu Paul G Nestor Ernst Niebur Brian F O'Donnell Raja

Parasuraman Michael I Posner Robert D Rafal Trevor W Robbins Lynn C Robertson Judi E See James Swanson Diane Swick Don Tucker Leslie G Ungerleider Joel S Warm Maree J Webster Sharon Wigal     *Encyclopedia of Human Memory* Annette Kujawski Taylor Ph.D.,2013-10-29 Providing clear comprehensible information for general readers this three volume A Z encyclopedia covers the major theories and findings associated with our understanding of human memory and some of the crippling disorders associated with memory malfunction This encyclopedia comprehensively addresses one of the most critical components of human intelligence memory Comprising approximately 500 A Z entries written by experts who have studied memory and its impacts the work defines complex terminology for lay readers and includes answers to the most common questions regarding human memory Readers will gain an understanding of the various psychological and physiological systems of memory such as short term or procedural memory comprehend the principles that underlie effective encoding storage and construction of memories and learn the truth about often misconceptualized conditions like amnesia or how our memories are stored in bits and pieces rather than linearly like a recorded tape or video This set is ideal for high school students writing term papers or studying for advanced examinations such as Advanced Placement AP in psychology The volumes also provide a breadth of information invaluable to family members friends and caretakers of individuals who suffer from various memory disorders including descriptions of major disorders explanations of specific memory deficits strategies for memory improvement and information on the parts of the brain that access and store memory as well as the types of tests used to assess memory loss Also included are biographies of key contributors to the field of cognitive psychology and to the area of memory in particular     Principles of Research in Behavioral Science Mary E. Kite,Bernard E. Whitley, Jr,2025-07-24 Now in its fifth edition this invaluable textbook provides a comprehensive overview of research methods in the behavioral sciences emphasizing the conceptual challenges inherent in scientific inquiry Organized to mirror each stage of the research process this text guides readers through the process from formulating questions to collecting data to interpreting results Engaging and accessible the book includes essential topics like measurement issues correlational research evaluation research and integrative literature reviews often overlooked in other textbooks Key features include Balanced coverage of both qualitative and quantitative research methods Structured chapter features including an outline key terms a summary suggested readings and reflective questions to facilitate discussion and application of theory Extensively updated chapters reflecting recent advancements with new discussions on the implications of open science and the challenges of effective online data collection Expanded resources for instructors and students to support teaching and learning Streamlined for an optimal balance of breadth and depth Principles of Research in Behavioral Science is an indispensable resource for any researcher s bookshelf Ideal for advanced undergraduate graduate and post graduate students seeking a strong foundation in research methods it also serves as a valuable reference for seasoned researchers looking to refresh their knowledge

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