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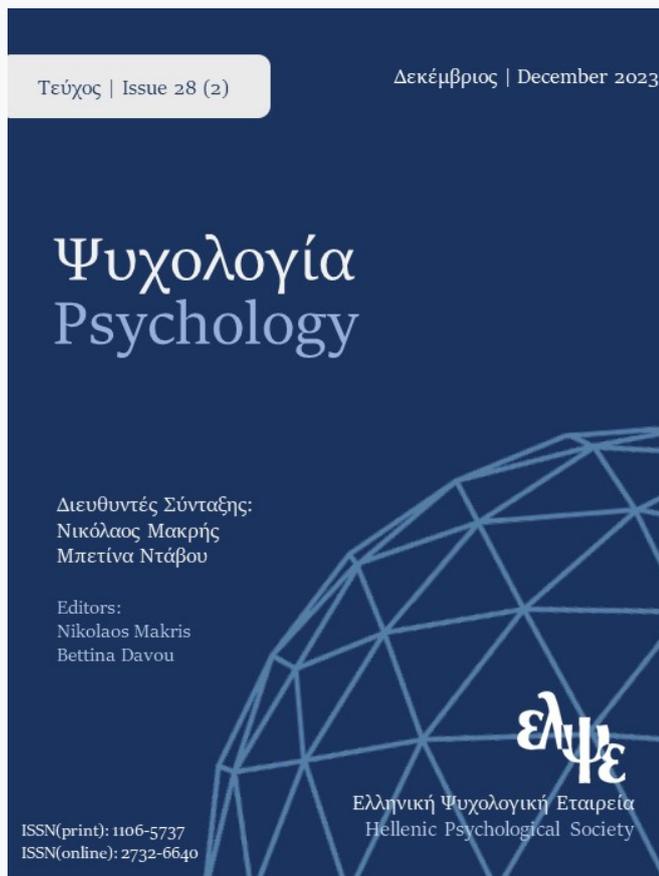
Special Section: Nous: A powerful machine

Consciousness: The Force is Back

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Consciousness: The Force is Back

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KEYWORDS	ABSTRACT
	This commentary discusses the papers included in this special issue which focuses on the role of consciousness in various aspects of behavior. The commentary first outlines dominant theories of consciousness and awareness. It then focuses on the papers included in the special issue, outlining the main findings or claims of each and embedding them in the general frame of the current study of consciousness. Finally, we conclude by outlining some general premises a general theory of consciousness would have to satisfy.

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Introduction

This special issue includes six papers related to consciousness and mental awareness from several points of view. Some papers are closer to this central theme and to each other than others; however, they all strongly suggest that consciousness and mental awareness eventually evolved to become again a central construct guiding psychological research and theory. To help the reader find a thread that connects the various papers, in this commentary I will first outline what consciousness is and the different theories and approaches adopted for its study. I will then summarize the various papers and show how each is related to the general frame proposed. Finally, I outline a general framework that may connect the various lines of research on consciousness and suggest possible directions for future research.

Consciousness: An Evolutionary Trick to Compensate for DNA's Liabilities

Consciousness is elusive. In evolution, nature opted for automaticity in the formation of successful living organisms. The snake striking, the eagle diving from the sky, the lion attacking, or the tennis player reacting to his opponent have no time to be aware of their action or the objects of their action; they are just locked onto them via perception from beginning to the end. Also, countless computations in the meantime pass completely unnoticed. All perceptual systems are like this. The faster and more automatic the better for the organism (Kouider & Faivre, 2017). However efficient automaticity is, evolutionary history or personal experience is not always enough to predict the world. The environment changes unaccountably, often causing failure of action. Failures render adjustments necessary online or offline, in premeditated plans of action. This is where consciousness began to emerge in evolution, and this is where it begins to develop in ontogeny: to enable predictive correction of error by building self-corrected models of the world and action within it (Cleeremans & Tallon-Baudry, 2021). In a sense, the brain evolved through millennia to enable consciousness to emerge as a complement to automatic systems constrained by histories fully encoded in the DNA and expressed by brain

structures serving perceptual systems and reflexes. Thus, consciousness is like a control board where objects from the environment and/or processes applied on them are projected so that past action may be reviewed and evaluated, and future action may be planned and improved. Powerful constructs in psychology, such as the Self, Identity, and Morality are possible as products of consciousness. The brain evolved to compensate for its lack in brain circuits serving automatic perception and action.

The study of consciousness has a convoluted history (Hilgard, 1980; LeDoux et al., 2020). Philosophers recognized its role for thousands of years. Socrates suggested that becoming aware of one's own ignorance is the first step to knowing: I know one thing, that I know nothing. Descartes set awareness of thinking in the center of human existence: I think, therefore I am. Kant suggested that that there is no intelligence without awareness. Spearman theorized that apprehension of experience, awareness of mental activity and its objects, is one of the two major laws of intelligence (Spearman, 1927). Freud (1911, 1915) placed consciousness and exchanges between consciousness and the unconscious in the center of mental life and mental health. However, in the early 20th century, when behaviorism dominated, consciousness was rejected as a an epistemologically legitimate object of scientific research. The cost for understanding human experience, learning, and behavior was much higher than the gains from the rigor of empirical research promoted by behaviorism. Thus, with the cognitive revolution that started in the 1950s, consciousness returned full force as an object of scientific study in psychology, neuroscience, and recently computer science and artificial intelligence (Dehaene, 2014).

Nowadays, understanding and explaining consciousness is one of the most important problems of science. How does consciousness emerge from the functioning of the brain? How chemical and electrical processes in the brain come to generate representations of the world, representations of these representations, and awareness of them? How does consciousness become part of interactions with the world for good, improving learning and adaptation, and for bad, causing misery and maladjustment? How does consciousness emerge in development? How an artificial mind can emerge from digital (or perhaps quantum) computing, become and conscious and of its own existence, aware of its content and operation, and eventually take control of its own computations and interactions with other agents, artificial or living? Perhaps, no technological or scientific revolution which has occurred so far can match the revolution to come when these questions are answered.

Several theories of consciousness and awareness were advanced in recent years in three separate fields: Cognitive and brain science, learning and education, and developmental science.

In cognitive and brain science there are basically four theories. The Global Workspace Theory (GWS), proposed by Bernard Baars (2005), claims that consciousness arises from the brain's ability to integrate and broadcast information from various specialized brain areas to a central "workspace." This integrated information is what is experienced consciously. The Integrated Information Theory (IIT), proposed by Giulio Tononi (2004), claims that consciousness arises from the integration of information within a system and its capacity to generate specific patterns of interconnectedness. According to IIT, the complexity of consciousness possible for a system is a function of the system's complexity to represent and integrate information. Other theories emphasized other aspects of the brain as sources of consciousness. For instance, the hierarchical organization of the brain allows building representations on representations, which become objects of awareness and hence mentally manipulable (Coward & Sun, 2007). Alternatively, by construction, the brain is integrative and predictive to fill in lags or correct distortions in incoming information and predict based on estimated privileged information or remembrances of the past (Gilead et al., 2020).

In learning and education, theories focused on learning, trying to accommodate the role of awareness in learning and performance in education. Theories in this field emphasized the role of awareness of cognitive processes in students' taking control of their own learning. Central in this field were constructs related to school-related cognitive processes. For instance, metacognition, i.e., awareness of cognitive processes such as memory, attention, reasoning, and language; learning to learn, i.e., learning how to self-regulate the learning processes; conceptual change, i.e., changes of concepts about the world to bring them closer to reality, with awareness being critical in conceptual change (Demetriou, 2000, 2014; Efklides, 2008).

In developmental science, theories focused on awareness of mental states as an important aspect of cognitive development and social adaptation. This is known as the Theory of Mind (ToM), implying awareness of children that others have mental states which influences how they interpret their intentions, beliefs, and behavior (Wellman, 2014).

The papers in the special issue

How do the papers in this special issue fare vis-à-vis the theoretical and historical frame outlined here? Overall, they nicely reflect the multiplicity and fragmentation of the field.

The paper by Eleni Ziori reviews research which explored the cognitive unconscious, showing how mental processes may cross the line between consciousness and the unconscious. This research focuses on implicit learning highlighting the power of unconscious processes within the framework of implicit learning. The paper shows that unconscious cognitive processes play a pivotal role in cognition and behavior, including language acquisition, social cognition, perceptual and motor skills. The paper discusses various theoretical and methodological issues about the various aspects of learning that occur without conscious awareness and outlines applications that might be useful in different learning settings and domains. The approach espoused in the paper would be enriched if showing more systematically when implicit learning breaks, making conscious processing necessary. The ideas in the paper would also benefit if more systematically connected with differential and developmental research.

The paper by George Spanoudis and Anna Tourva are close in spirit to the paper of Ziori in that it focuses on simple and automatic processes to explore their relations with complex and effortful processes in intelligence. They present a study which explored the relations between visual inspection time task and intelligence. Individuals from 7 to 18 years were tested in a visual inspection time task, a Go/no-go reaction time task, a letter-matching task, and the Wechsler Abbreviated Scale of Intelligence. They used diffusion modeling to show that inspection time captures top-down sensory and attentional processes underlying the relation between inspection time and intelligence. They also showed that individual differences in drift rate of elementary cognitive tasks which are supposed not to involve complex processes such as reasoning predict individual differences in intelligence. This may imply that control processes may be present even in simple processes which frame how decision making and reasoning are built. This kind of research would benefit if measures of awareness and self-monitoring were available that would highlight how automatic visual inspection processes interact with effortful and explicit processes.

Two papers present research directly related to the study of educational and developmental aspects of consciousness. The paper by Zoe Bablekou, Elisavet Chrysochoou, and Smaragda Kazi presents a study on the relations between executive functioning, listening comprehension, metacognitive-metacomprehension about them, and intelligence in children from 5 to 8 years of age. The study showed that cognitive performance improved with age, but metacognitive awareness and self-evaluations did not follow suit. That is, some children who did not perform well overestimated their performance and others who performed well underestimated their performance. Notably, working memory and listening comprehension together with their metacognition and metacomprehension differentiated between cognitively strong and cognitively weaker children, implying a role of awareness for the formation of cognitive performance. This was reflected in higher performance in inhibition and awareness about it, implying that the grasp of awareness is crucial in cognitive performance at a period of cognitive developmental transition. Most likely, had they included older children from 8 to 11 years, the expected sheer improvement in awareness would have emerged.

These factors are discussed in the paper by Elisavet Chrysochoou which focuses on the biological and cognitive mechanisms in the development of theory of mind and the possible role of culture in this development. This paper compares theories emphasizing domain general mechanisms of development with theories emphasizing their modular origin. Chrysochoou adopts an integrative, interdisciplinary gearing on a biocultural perspective aiming to shift attention to the interplay of biological, cognitive, and environmental factors in cognitive development. Chrysochoou's paper is a useful addition to this special issue because it highlights the role of social and cultural factors in the formation of important products of consciousness, such as personal identity, self-concept, and self-other differentiation. For instance, it is notable that although mechanisms of ToM are universal, individuals developing in collectivist cultures such as Japan, differentiate self from other less sharply than individuals developing in the individualist cultures of the West.

These concepts present a nice link with the last two papers in this collection which present research on the effects of social media and internet communication on awareness and activity. The paper by Sidiropoulou and Metallidou paper focuses on the role of metacognition in human–Internet interactions. The paper is interesting in showing that human awareness allows individuals to use the internet as an extended knowledge and learning field. It is shown that internet users take the internet as a cognitive partner rather than as a tool which can assist

in finding answers to questions and in relieving memory from unnecessary cognitive and recall load for needed information. It is shown that metacognitive awareness is pivotal in enabling individuals to decide what to search for on the internet, how to combine information possessed with information retrieved from internet search, and how to synthesize questions, information possessed, and information retrieved. People see the internet as an information source they can interact with or as a storage device, a super memorizer to be called upon when needed. Able users of the internet give more correct answers when seeking help from the internet than others and they are more self-confident with their answers. In short, the paper shows that cognitive tools such as the internet enhance both cognitive efficiency and the overall field in which mental awareness is practiced. It would be interesting if developmental research would also be reviewed in this paper to shed light on possible changes in development in using the internet as a problem solver and knowledge enhancer. This is particularly important after the appearance of artificial intelligence programs and agents as cognitive enhancers.

The paper by Petros Roussos examines the influence of digital technologies on cognitive processes such as attention, memory, problem-solving, and decision-making. This includes the effects of multitasking and task switching on attention and memory, using the internet to enhance memory, utilizing heuristic-based search strategies while navigating the web and assessing the credibility of information obtained online. Multitasking is already a commonplace activity in different contexts, such as in lectures, meetings, etc. Many more studies reported negative associations between media multitasking and cognitive skills, such as performing worse on switching between tasks, attention focusing tasks, and showing limited reading comprehension when time is constrained and extends the duration of the reading task when readers can regulate their reading speed. Also, searching the Internet for answers leads seekers to an illusion of knowledge, confusing externally accessible information with one's personal knowledge. Obviously, in the not-so-distant future, applications will be available to allow instant access to information in ways that do not require conscious search on the part of the user but will be related to their actions or even their thoughts. This is disconcerting because it seems that Freud's id will expand to a huge space of a *digital id*. Obviously, a very strong personal Ego will be needed to deal with the forces of the digital id if a counterforce of a digital Ego and Super Ego is not present.

Conclusion: Is a general model possible?

The field is highly fragmented, lacking commonly accepted concepts and constructs and methods for their study. For instance, there is no agreement if the human mind (and brain) is modular or if it involves central constraining processes (or abilities). As a result, there is no agreement about the role of consciousness in any of the domains outlined above. Notably, two important theories, the GWP and the IIT of consciousness are currently compared experimentally (Melloni et al., 2023). We would argue that all automatic systems although modular, such as the various senses, are integrative in the sense that they all integrate information specific to their functioning, such as sounds for hearing, visual patterns for vision, etc. Consciousness emerged as an integrator over modular integrators. This is needed, basically, for two reasons. To correct for errors of automatic action when the world does not conform to expectations and construct more broad representations of situations sampling over co-activated modular systems, such as hearing, vision, smell, etc. concerning an action towards an object, such as the snake's strike onto a mouse, the eagle's dive onto a rabbit, the tennis player's launch of a ball into the other's side, etc. In the long run, it may look like a huge distance to go from integrations at this level to integrations over sentences to produce speech, over premises to produce logical conclusions, over quantities to produce mathematical rules, etc. Consciousness so conceived is a reflective metarepresentational mechanism recording objects of in the world, actions, and representations about them, and feeding back to them in sake of their improvement (Demetriou et Demetriou, Makris et al., submitted; Demetriou, Spanoudis et al., 2024). This may be expressed in various forms. For instance, in changes in the resolution and precision of awareness of the representational and inferential origins of knowledge, in ToM, in the state and relations between mental processes applied on different problems, etc. The papers in this special issue deal with specific aspects or components of consciousness, avoiding interlinking their findings or assumptions with these general principles. It would probably be interesting to see how each of the authors of the papers included in the special issue would connect their research to this framework. And of course it would be highly interesting to discuss how individual consciousness shall engage with artificial consciousness and intelligence in the years to come.

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ΠΕΡΙΛΗΨΗ

Αυτό το σχόλιο συζητά άρθρα που περιλαμβάνονται σε αυτό το ειδικό τεύχος που είναι αφιερωμένο στον ρόλο της συνείδησης ως προς διάφορες απόψεις της συμπεριφοράς. Το σχόλιο αρχικά σκιαγραφεί τις κυρίαρχες θεωρίες της συνείδησης και της αυτεπίγνωσης. Στη συνέχεια συζητά τις εργασίες που περιλαμβάνονται στο ειδικό τεύχος, περιγράφοντας τα κύρια ευρήματα ή τις θέσεις του κάθε άρθρου, με σκοπό να τα εντάξει στο γενικό πλαίσιο της τρέχουσας έρευνας για τη συνείδηση. Τέλος, το σχόλιο καταλήγει προτείνοντας ορισμένες γενικές αρχές που πρέπει να ικανοποιεί μια γενική θεωρία της συνείδησης, επισημαίνοντας τη θέση του όλου ειδικού τεύχους ως προς αυτές τις αρχές.