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## **Creativity, cognition, and material culture: An introduction**

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Creativity is a central aspect of human becoming and fundamental to understanding the complex biosocial nature of the mind. The process of creativity is being perceived, studied and valued as an essential parameter in the examination of change and transformation in human beings. Yet, questions about the major driving forces that spark, mediate, shape and constitute human creative agencies, as well as about how and why the creative capacity may have emerged, transformed and developed in human evolution and ontogeny, remain the subject of considerable debate and confusion. The latter arises in part because the creative process raises issues about the situated character of human intelligence, the centrality of fabrication in human life and the relational nature of the interaction between cognition and material culture. Research in creativity rarely considers the explanatory power of these embodied interactions and their contexts. This is not because the interactions are uninteresting, but rather because common psychological methods and analytical units are unable to accommodate their dynamical properties and situated nature. This is one of the main areas where, we hope, this special issue can make a useful contribution by showing how our understanding of the science of creativity can be enriched and transformed once we come to appreciate the constitutive intertwining between cognition and material culture.

In recent decades, reductionist approaches looking at the neuronal underpinning(s) of creativity have claimed to provide the way forward for making creativity a tractable neuroscientific question. Yet, how far have we really come in the search for the creative mind? Is localizing the cognitive processes involved in the brain an inherently limited approach? And if so, where should we go next? Despite undeniable progress in the way creativity can be measured and quantified in the laboratory with a combination of new brain imaging and psychometric techniques, the crucial question of how to align and connect neural activation patterns with the various embodied, psychological and material dimensions associated with the creative process remains less understood. We argue the problem is twofold. On the one hand, to date, there has been no systematic interdisciplinary attempt to integrate the new empirical findings from the neuroscience of creativity with their evolutionary and anthropological foundation. In this regard, it is important that we contextualize the question of how creative activity is instantiated in the functional architecture of the brain, and critically review the fundamental assumptions underlying current tendencies to isolate creative activity inside the head so that it can be associated with particular brain regions. On the other hand, our basic definition of creativity has changed little, despite the accumulated evidence of many disciplines indicating that the definition may have long outlived its usefulness. Indeed, basic questions—like, what makes human creativity distinctive, and where can it be found?—need rethinking. We need to re-

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examine ‘common sense’ assumptions about human creativity, like the popular belief that creativity is solely a mental capacity, or accomplishment, of the isolated individual. The most advanced neuroimaging and psychometric techniques will be of little help without greater analytical clarity about the nature and whereabouts of the human creative process. Clarifying these issues can help scientists re-examine the ways creativity is measured in the laboratory and chart new directions for future research.

The need to address these problems and formulate new ways of overcoming them is what inspired the development of this volume, which, we should note, is largely based on the Creativity Lecture Series organised by the Advanced Studies Centre (ASC) at Keble College, University of Oxford between 2010 and 2015. The purpose of the lecture series, and by extension of this special issue, is to present new research developments and theoretical approaches to the study of creativity from different disciplines and reflect on artistic, scientific and anthropological aspects of the creative process.

The issues addressed in this special issue are ambitious and fundamentally interdisciplinary in scope. The articles integrate empirical case studies and theoretical insights from different disciplines (archaeology, anthropology, psychology, cognitive science and cybernetics) on the material bases of creativity in terms of the evolution and development of human cognition, the mapping of the brain and the embodied, ecological and anthropological dimensions of the creative process. Drawing together a number of different and usually unconnected threads of evidence and methods, we delve into the process of human creativity and explore its properties as an extended and distributed phenomenon comprised of both neural and extra-neural resources. We believe that creativity is not necessarily tied to specific universal mechanisms, nor is it reducible to neural events on the order of milliseconds. Instead, insofar as it has real life, duration, evolutionary significance and meaning, creativity is situated and related to the ecology, materiality and phenomenality (the what-it-is-like) of creative experience. We want to identify and describe the totality of ontological ingredients and constitutive elements of the creative process, in the making. We should keep in mind, finally, that the creative process has been, and continues to be, a major factor in human evolution. The study of the evolutionary and developmental dynamics of our species could benefit from a more holistic approach to the study of the creative process underlying material innovation.

To this end, the special issue covers a wide range of topics and materials, with some emphasis on underexplored areas like cultural variation in creativity, plasticity, cyborg-creativity, distributed creativity and the relationship between creative thinking and material culture. Scholars from a range of disciplines consider new ways of exploring the links between brain activity, bodily activity and material culture by investigating the interactive effects of materiality on creativity. We seek to characterize the nature of the cognitive operations involved in performing a creative task and understand how the human brain, working in concert with the human body, interacts with material culture to construct new things. As might be expected, the articles have some interesting differences as well, but taken together they offer new directions for research. In this way, we hope to sketch a proposal for pure and applied research on the material basis and distributed nature of human creativity that might serve as a guide for future interdisciplinary studies.

David Kirsh contrasts the neurocentric model of creativity with a distributed model that additionally incorporates material culture and bodily movement. Kirsh highlights the importance of chance and random variation in the material interactions through which creativity occurs,

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illustrating these insights with the popular word game Scrabble and dance choreography. Frédéric Vallée-Tourangeau similarly reconceptualises human creativity as a process of dynamic interaction with material structures and artefacts that provide distributed resources for insight, problem solving and courses of action. Recognising creativity as a process that is simultaneously psychological, embodied and embedded in a physical world can suggest new ways of conceptualising and researching it in ecologically valid situations. Expanding the historic view of a creative individual working in isolation—the blacksmith in his workshop—Thomas Wynn and Frederick L. Coolidge situate the creative agent in an ecology of materials, tools and knowledge resources to examine how novelty and innovation arise through mechanisms of procedural drift, serendipitous error and fiddling. They also review the brain's contribution to creativity, focusing on working memory, as well as a role for the cerebellum emerging in recent neurological literature.

Carl Knappett and Sander van der Leeuw examine how an innovation and technological change like the rotating potter's wheel may have spread and flourished—or failed to do so—in the east Mediterranean of the Bronze Age. They highlight the various scales of change that need to be considered, including the individual (the micro level), the social (macro), and the communities of practice (meso) whose organization and structure inform the likelihood of innovative adoption or decline. Chris Gosden likewise examines the social effects of change and innovation, using the case study of the early medieval English landscape, where individual decisions and rather mundane transactions accumulate to decisively transform the use of landscape, the style and organization of village life and the very identity of the people. Rounding out the examination of creativity through a cultural lens, Maurice Bloch contrasts the unselfconscious creativity of the Zafimaniry people of Madagascar, whose intricate carving of wooden shutters and doors is inseparably integrated with social values like the continuity of communal and family life, with the intentional and self-aware creativity of European artists, which values individuality, originality and creative merit. Bloch identifies the latter as a Westernized construct and suggests the former may be closer to what creativity has been throughout most of human history.

Using examples from music, calligraphy and lace-making, Tim Ingold lyrically envisions creativity as a process of growth and undergoing, one that cannot be parsed as simply the generation of novelty but which necessarily includes material lifespans, the interactive processes by which they are fabricated and the engagement of a physical world in a state of constant flux. Drawing on his theory of material engagement, in which cognition is envisioned as the dynamical interaction of brains, bodies and materiality, Lambros Malafouris proposes and examines the notion of creative 'thinging', as the human species-unique commitment to the discovery of new varieties of material forms through a saturated, situated engagement of thinking and feeling with things and form-generating materials. Finally, Kevin Warwick reviews various ways in which the human body can be supplemented, expanded and integrated with material artefacts and technology, using his unique insight as both researcher and test subject. His work reminds us to question where the boundaries of any model of creativity are reasonably drawn between brain, body and material.