

Introduction. Differential Heterogenesis: Deleuze, Mathematics and the Creation of Forms

by ALESSANDRO SARTI AND ANNA LONGO

Within the vast field of Deleuze studies, a new area of interest is arising world-wide concerning the mathematics that inspire the dialectic of *different/ciation*. This renewed interest is crucial for situating Deleuze's philosophy with respect to other contemporary mathematical or formal ontologies, such as Alain Badiou's, and when comparing his approach to the emergent speculative realisms and materialisms that are rediscovering the fundamental link between the scientific modelization of reality and the philosophical problem of legitimizing knowledge. Traditionally, Deleuze studies have focused on the process of intensive individuation that happens at the level of actuality, without paying too much attention to the virtual differential structures which allow for the becoming of these processes. It is in this regard that in recent years Deleuzian concepts such as "differential", "singularity", "fold", "multiplicity", and "series" have been understood as referring to the level of the virtual conditions for the actualization of real beings, i.e. to the mathematical model of differential genesis that can be found in Leibniz, Maïmon, Lautman and Riemann (see Duffy 2006, 2013; Somers-Hall 2012; Van Tuinen & McDonnel 2010; Longo 2016). These studies cast a new light on the process of actualization that goes from the virtual conditions of the problem, the distribution of singularities (differential relations), to their solutions, that is the actual beings that result from an operation of integration.

Deleuze's perspective was inspired by Leibniz and Maïmon, who considered representation as flowing from the ideal rules for the construction of reality: in this way, they provided an answer to the question concerning the legitimacy of the subjective construction of objects. Rather than constituting a mere inductive abstraction, or rather than amounting to the arbitrary application of given *a priori* concepts, Leibniz and Maïmon claimed that representation depends on the same differentials that allow for the real genesis of objects. Accordingly, knowledge "flows" from the conditions of existence of material beings. Following Albert Lautman's philosophy of mathematics (Lautman 2011), Deleuze developed the former's differential account of the genesis of the individual into an anti-Hegelian dialectic according to which dx , the symbol of difference, substitutes the role of contradiction (see Deleuze 2001: 170) as the engine that produces history. According to Hegel, differences must be pushed to the point of their contradiction in order to be resolved into the universal identity of the Idea. Conversely, according to Lautman, ideas are the conditions of variable problems that allow for a plurality of

solutions. In a similar way, Deleuze's plane of immanence is animated by the variation of the distribution of differences (singularities) which constitute the condition for the actualization of non-contradictory heterogeneous realities that cannot be reduced to any universal unity or identity. Moreover, the study of Deleuze's engagement with the history of calculus allows us to clarify his position with respect to the computational model of the mind: rather than reducing the activity of thinking to the manipulation of discrete pieces of information, he is interested in showing the genesis of discrete forms from the continuum by relying on intensities (sensible differences).

However, this issue does not solely intend to re-assess Deleuze's work on mathematics, but, more importantly, it aims to create, in the spirit of the philosophy of difference, new concepts and theoretical tools to deal with problems that matter today, such as technological and digital production. More particularly, this issue focuses on Alessandro Sarti's and Giovanna Citti's recent mathematical tool, which they call "Differential Heterogenesis" (see Sarti, Citti & Piotrowski 2018). This latter is a mathematical framework that formalizes the Deleuzian ambition to deal with heterogeneous differential operators, in order to overcome the technical limitation that mathematical physics cannot deal with homogenous operators within a given phase space. Differential heterogenesis aims to provide a mathematical description of the emergence and creation of forms whose conditions are not *a priori* given within a definitive set of possibilities. Or, to put it otherwise, it allows us to account for the historical variation of the phase space (the set of all the possible trajectories), rather than being limited to mapping the possible trajectories that are already included in a given model. As a consequence, differential heterogenesis allows us to consider the becoming or differentiation of the *a priori*, which as plural are themselves responsible for the actualization of heterogeneous realities. Accordingly, this issue proposes to extend this scientific enquiry to the study of phenomena that classic mathematical modelization cannot grasp satisfactorily, i.e. historical phenomena whose variation cannot be *a priori* established with a given set of possible outcomes such as the evolution of living forms, language, knowledge, artistic expressions or theoretical and technological inventions. Heterogenesis identifies its own empirical domains within the dynamic production of the real objects which are studied by cognitive sciences (the material structure of the brain and the emergence of thinking), by the sciences of the living (phylogenetic becomings), by semiotics (the genesis of meaning), by history (the particular micro-histories irreducible to universal progress), by politics (the emergence of insurrectional flows from multitudes), and by art practice (experimentation producing alternative realities).

The articles here gathered testify of the variety of research fields and creative practices that Deleuze's philosophy of difference is able to stimulate, to challenge and to transform. The differential schema of genesis has been employed as a tool for criticizing

postures in physics, mathematics and information technology (see in this issue Giuseppe Longo, Ben Woodard, Michael Eby), and it has been critically compared to other contemporary philosophical approaches (see Daniel Sacilotto, Mehdi Parsa, Ekin Erkan). Furthermore, differential heterogenesis has been taken as an occasion for looking at the history of philosophy while rediscovering ideas and concepts which can help to think about the present (see Andrea Cavazzini, Jean-Claude Dumoncel, Thomas Detcheverry), and it has been taken as a standpoint for rethinking political, social and ecological organizations (see Igor Pelgreffi, Jacob Vangeest, Franck Jedrzejewski). Finally, it is evident that the arts are one of the most active field of experimentation for the metamorphic morphogenesis that Citti and Sarti are proposing as a mean for reconceiving the relation between perception, knowledge, and reality (see Pascale Criton, Guy Zimmerman, Pablo Gonzales).

We are proud of presenting such a relevant constellation of resonating voices and meaningful insights, for this reason, we are very thankful to the amazing team of La Deleuziana who made it possible. We are also grateful to the translators Alexander Campolo and Alexander Miller and to the proofreaders Tim Deane-Freeman, Aragorn Eloff and Inigo Wilkins. We hope the readers will enjoy the contributions we are proposing as much as we did and that they will let their minds to enter the most exciting process of differentiation.

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