

# **SHAPES 3.0**

## The Shape of Things

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In conjunction with the CONTEXT 2015 conference

### **Editors**

Oliver Kutz | Stefano Borgo | Mehul Bhatt

## Shapes 3.0 – Organisation

### Programme Chairs

Oliver Kutz	Research Centre for Knowledge and Data (KRDB) Free University of Bozen-Bolzano, Italy
Stefano Borgo	Laboratory for Applied Ontology (LOA) ISTC-CNR, Trento, Italy
Mehul Bhatt	Cognitive Systems Group (CoSy) University of Bremen, Germany

### Programme Committee

John Bateman	University of Bremen, Germany
Tarek Besold	Free University of Bozen-Bolzano, Italy
Emilios Cambouropoulos	Aristotle University of Thessaloniki
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## PREFACE

### **Shape, Form, and Structure**

The third event of the SHAPES series helped to make one step further in the understanding of the meaning of terms like shape, form, structure and related notions. We often take these concepts for granted within the diverse disciplines but once we start focusing on them or attempt to clarify their relationships we discover that their actual meaning is elusive and far from clear. Studies on shape, form and structure range from humanities (literature, arts) to sciences (chemistry, biology, physics etc.) and within these from the formal (like mathematics) to the empirical disciplines (such as engineering and cognitive science). Even within domains such as computer science and artificial intelligence, these notions are replete with common sense meanings (think of everyday perception and communication), and formalisations of the semantics and reasoning about shape, form, and structure are often contextual and *ad hoc*. Several approaches to study such notions have been proposed and discussed within and across the different disciplines but they just led to the conclusion that we are far from understanding how to make sense of the different standpoints and of our common sense intuitions. In short, a comprehensive treatment of these notions is currently lacking and no widely accepted formal or interdisciplinary perspective has emerged so far.

The aim of the workshop series SHAPES is to provide an interdisciplinary platform for the discussion of topics connected to the core meanings of terms related to shape (broadly understood): perspectives from psycho-linguistics, ontology, computer science, mathematics, aesthetics, and cognitive science, amongst others, are expected to be addressed and to be discussed in the workshops. Researchers need to engage in open discussions and comparisons of the contributions of the different disciplines in dealing with shape related notions, and in particular an important contribution is expected from those domains where shape representation and reasoning have an essential role. These include formal, cognitive, linguistic, engineering and philosophical aspects of space, as well as their application in the sciences and in the arts.

We also welcome contributions on the relationship of shape representations at different levels of detail (e.g. 2D, 3D) and in different logics, and with respect to different qualitative and quantitative dimensions, such as topology, distance, symmetry, orientation, etc.

### **Form and Function in Natural and Artificial Systems**

Within the philosophy and practice of design, the notions of shape, form and structure have a further role of constraining function, malfunction, and behaviour of things. In this perspective, the design process is a trade-off between several dimensions: physical, logical and cognitive laws and constraints intertwine in creating shapes and in attributing functionalities. Here, several aspects of shape modeling, from spatio-linguistic to conceptual and computational, contribute towards the construction of suitable models of artifacts. This line of thought extends to several other disciplines beyond the design of technical systems, e.g., in socio-

technical or biological systems. For instance, in biochemistry the shape of molecular entities (proteins, small molecules) has a direct effect on their interactions which give rise to the capacities they can manifest and, in turn, to the processes of life and death. Representing and reasoning about the shapes and their potential functionalities of these entities is essential to understand basic biological processes. Of special importance, in this as well as other contexts, is the understanding of shape complementarity, that is, categorising the shapes of things and that of holes and relate these in terms of shape and functional fitting: a thing that fit a hole can either facilitate or block the functionality of the single entity and enrich or diminish that of the overall system.

The SHAPES workshops stimulate and facilitate an active exchange on interdisciplinary applications, ideas, approaches, and methods in the area of modelling shape, form, structure, pattern and function. The format of the workshops combines invited speakers, peer-reviewed full contributions, as well as short position and demo papers, and allows ample time for open discussions amongst the participants. Typical topics include:

**Linguistics / Philosophy** shape and form in natural language; differences between shape, form, structure, pattern and function; shape in natural and artificial objects.

**Cognition** shape perception and mental representation; gestalt vs. structuralist understanding of shape cognition; perception and shape (e.g. identifying objects from incomplete visual information); affordances, dispositions, and shape.

**Logics, Spatial Representations** formal characterisations of shape and form; logics for shape: e.g. fuzzy, modal, intensional; logics for topology, symmetry, shape similarity; design semantics, spatial semantics; shape and 3D space; shape and space in cognitive assistance systems.

**Ontology** ontologies and classifications of shapes; ontological relations among shape, objects and functions; patterns as shapes of processes; forms and patterns in ontology.

#### **Applications**

*Biology and Chemistry:* molecular shapes, shape in anatomy and phenotype definitions, shape complementarity between objects and holes, shape in medical image analysis and annotation.

*Visual Art and Aesthetics:* shape in Film and Photography; shape in computational creativity.

*Naive Physics and Geography:* e.g. qualitative classifications of shapes of geographic objects.

*Design and Architecture:* shape grammars; CAD, symmetry and beauty in architectural design.

*Engineering:* formal shape analysis in engineering processes.

The workshop SHAPES 3.0 is the third event in the SHAPES series.

The first event, SHAPES 1.0, was held in conjunction with CONTEXT 2011 in Karlsruhe, Germany.<sup>1</sup> The proceedings have been published as Vol. 812 of

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<sup>1</sup>See <http://cindy.informatik.uni-bremen.de/cosy/events/shapes/> for the workshop website

the CEUR workshop proceedings, edited by Janna Hastings, Oliver Kutz, Mehul Bhatt, and Stefano Borgo, see <http://ceur-ws.org/Vol-812/>.

The second event, SHAPES 2.0, was held in conjunction with UNILOG 2013 in Rio de Janeiro, Brazil.<sup>2</sup> The proceedings have been published as Vol. 1007 of the CEUR workshop proceedings, edited by Oliver Kutz, Mehul Bhatt, Stefano Borgo, and Paulo Santos, see <http://ceur-ws.org/Vol-1007/>

SHAPES 3.0 confirmed the trend of the previous events running as a full day workshop with 3 invited speakers and 8 contributed talks. These proceedings contain 2 invited papers by John Bateman and Emilios Cambouropoulos, as well as 7 contributed papers. We thank all the speakers for their interesting presentations, and the audience for generating very lively and fruitful discussions.

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<sup>2</sup><http://cindy.informatik.uni-bremen.de/cosy/events/shapes2/>

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[www.iaoa.org](http://www.iaoa.org)

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