Journal of Artificial General Intelligence 6(1) 1-4, 2015
DOI: 10.1515/jagi-2015-0001

Submitted 2015-12-21
Accepted 2015-12-21

Editorial: Computational Creativity, Concept Invention, and General Intelligence

Tarek R. Besold TAREKRICHARD.BESOLD@UNIBZ.IT
KRDB Research Centre, Faculty of Computer Science
Free University of Bozen-Bolzano
Bozen-Bolzano, Italy

Kai-Uwe Kühnberger KKUEHNBE@UOS.DE
Institute of Cognitive Science
University of Osnabrück
Osnabrück, Germany

Tony Veale TONY.VEALE@UCD.IE
School of Computer Science
University College Dublin
Belfield, Dublin D4, Ireland

Editor: Tarek R. Besold, Kai-Uwe Kühnberger, Tony Veale

Abstract

Over the last decade, computational creativity as a field of scientific investigation and computational systems engineering has seen growing popularity. Still, the levels of development between projects aiming at systems for artistic production or performance and endeavours addressing creative problem-solving or models of creative cognitive capacities is diverging. While the former have already seen several great successes, the latter still remain in their infancy. This volume collects reports on work trying to close the accrued gap.

Keywords: computational creativity, artificial intelligence, problem-solving, cognition

1. The Field as It Stands

Computational creativity is a multidisciplinary endeavour, originally started as part of research in Artificial Intelligence (AI) but as of 2015 also covering topics in cognitive psychology, philosophy and the arts (a concise overview of the history of the field has, for instance, been laid out by Boden, 2015). In terms of definition of the subject area of computational creativity as scientific discipline, Colton and Wiggins (2012) suggest the following:

> "The philosophy, science and engineering of computational systems which, by taking on particular responsibilities, exhibit behaviours that unbiased observers would deem to be creative."

In practice, the goal of computational creativity is to model, simulate or replicate creativity using a computer, in order to achieve one of several ends: Either to construct a program or computer capable of human-level creativity, or to better understand human creativity and to formulate an algorithmic perspective on creative behaviour in humans, or to design programs that can enhance human creativity without necessarily being creative themselves. As a field, computational creativity therefore concerns itself with theoretical and practical issues in the study of creativity. Theoretical work on the nature and proper definition of creativity (with a strong emphasis towards aspects which are also relevant for or to be found in computationally creative systems) is performed in parallel with practical work on the implementation of computational modules (within more complex and/or general architectures) or entire dedicated systems that exhibit creativity, with the theoretical considerations informing the applied strand of work and vice versa.

Computational creativity as an academic field in its own right has enjoyed growing popularity over the last decade since the First Joint Workshop on Computational Creativity in 2004: In 2015, the International Conference on Computational Creativity (the latest edition of the academically matured successor series of events of the Joint Workshops on Computational Creativity) witnessed its sixth edition, four currently ongoing FP7 FET-Open research projects are explicitly dedicated to questions in computational creativity, and the FP7 3-year coordination action ”Promoting the Scientific Exploration of Computational Creativity (PROSECCO)” since 2013 has been actively promoting computational creativity also to the general public. Scientifically, papers reporting on work in computational creativity are by now part of the standard repertoire of every major AI conference and frequently appear in high-ranking journals, and IJCAI-2015 at Buenos Aires for instance featured a dedicated track on “AI and the Arts”. Also, with (Besold, Schorlemmer, and Smaill, 2015) the first book reporting exclusively on research conducted in the field of computational creativity has been published, and already before that several other collections dedicated a significant share of attention to the topic (McCormack and d’Inverno, 2012; Veale, Feyaerts, and Forceville, 2013).

With respect to the achieved results, several artificial systems have been accepted as creators of artistic artefacts (and, thus, potentially as creative) by the corresponding audiences: Among others, music composed by the University of Malaga’s Iamus system (Diaz-Jerez, 2011) has been performed and recorded by world-famous artists and orchestras such as, for instance, the London Symphony Orchestra, and paintings produced by Cohen’s AARON (McCorduck, 1991) have been sold in the standard art market since the 1970s. By now, even the culinary arts have partially been computerised. IBM’s Watson system has successfully been adapted to produce novel and interesting cooking recipes (Pinel, Varshney, and Bhattacharjya, 2015), the outcomes of which have been selected and prepared by internationally leading chefs and featured at different festivals and receptions. And also some of the creations of Ventura (2015)’s PIERRE system have found positive reception when served at the “*You Can’t Know My Mind*” creativity festival.

Still, on the more cognitive system and problem-solving oriented side, progress has been slower and many questions concerning the cognitive nature and computational modelling of creativity, for instance in concept invention, idea generation, or inventive problem-solving, remain unanswered. This delay in development is partially due to one of the fundamental questions in creativity research and computational creativity, namely the question for a general definition of creativity as cognitive capacity. While it usually seems straightforward for humans to recognise (or at least judge) the presence or absence of creativity in different forms of artistic performance or in a solution to a problem or task, giving an explicit characterisation of creativity or reasonably general criteria for deciding when an artefact, behaviour, or idea has to be acknowledged as creative has hitherto not been achieved. This lack of definition impacts more on one of the two general types of research in computational creativity: In the case of artefact-producing or art-performing systems in most cases emphasis and attention is almost exclusively given to the output which can be used for evaluation and subsequent guidance of the systems’ further development. This unfortunately doesn’t hold true for the more process-focused problem-solving side of the research spectrum. The latter is significantly impaired by the lack of process models or mechanistically-informative theories which could serve as basis for a computational (re-)implementation of creativity.

2. The Special Issue on "Computational Creativity, Concept Invention, and General Intelligence"

In order to create a dedicated forum for research working towards eventually overcoming this impairment, at ECAI-2012 the series of annual workshops on "Computational Creativity, Concept Invention, and General Intelligence (C3GI)" has been created. While still maintaining close ties and frequently also hosting researchers from the arts-focused side of computational creativity research, emphasis is put on research which reconnects with the original questions and dream of AI, namely the computational (re-)creation of cognitive capacities including intelligence and creativity on a human level.

This is also reflected in the structure of the present special issue. It combines articles on work which has originally been presented at the 2014 and 2015 editions of C3GI (held at ECAI-2014 in Prague and at UNILOG-2015 in Istanbul, respectively) with reports on new initiatives prepared specifically for this collection. Tony Veale assesses the role of creativity in generative systems, having a closer look at Twitterbots (i.e., automatic text generators on the online social networking service Twitter) as point of intersection between human expectations and current technological feasibility regarding computational creativity. Maria M. Hedblom, Oliver Kutz, and Fabian Neuhaus then examine the suitability of image schema theory–a conceptual framework proposed in cognitive linguistics–as foundational theory for concept invention in human cognition and artificial systems, before Stephen McGregor, Kat Agres, Matthew Purver, and Geraint A. Wiggins give an analysis of the relationship between lexical spaces and contextually-defined conceptual spaces, offering applications to creative concept discovery based on semantic spaces. This is followed by the presentation of Hugo Goncalo Oliveira's Tra-la-Lyrics 2.0 system as automatic generator for song lyrics within semantic domains created from seed words, before Thomas Manzini, Simon Ellis, and James Hendler describe an IBM Watson-based model and implemented system solving clues in syllacrostics word puzzles. The volume is concluded by an article by Petros Stefaneas and Ioannis M. Vandoulakis discussing a logical representation (and steps towards a corresponding semantics) of certain aspects of the process of mathematical proving with relevance for Artificial Intelligence.

We want to thank the authors for their contributions and wish them all the best for their future work in an exciting and captivating area of research.

Tarek R. Besold, Kai-Uwe Kühnberger, Tony Veale

References

Besold, T. R.; Schorlemmer, M.; and Smaill, A., eds. 2015. *Computational Creativity Research: Towards Creative Machines*, volume 7 of *Atlantis Thinking Machines*. Atlantis Press.

Boden, M. A. 2015. How Computational Creativity Began. In Besold, T. R.; Schorlemmer, M.; and Smaill, A., eds., *Computational Creativity Research: Towards Creative Machines*, volume 7 of *Atlantis Thinking Machines*. Atlantis Press. v–xiii.

Colton, S., and Wiggins, G. 2012. Computational creativity: the final frontier? In *ECAI*, volume 12, 21–26.

Diaz-Jerez, G. 2011. Composing with Melomics: Delving into the computational world for musical inspiration. *Leonardo Music Journal* 21:13–14.

McCorduck, P. 1991. *Aaron's code: meta-art, artificial intelligence, and the work of Harold Cohen*. Macmillan.

McCormack, J., and d'Inverno, M., eds. 2012. *Computers and Creativity*. Springer.

Pinel, F.; Varshney, L.; and Bhattacharjya, D. 2015. A Culinary Computational Creativity System. In Besold, T. R.; Schorlemmer, M.; and Smaill, A., eds., *Computational Creativity Research: Towards Creative Machines*, volume 7 of *Atlantis Thinking Machines*. Atlantis Press. 327–346.

Veale, T.; Feyaerts, K.; and Forceville, C., eds. 2013. *Creativity and the Agile Mind: A Multi-Disciplinary Study of a Multi-Faceted Phenomenon*, volume 21 of *Applications of Cognitive Linguistics*. De Gruyter Mouton.

Ventura, D. 2015. The Computational Creativity Complex. In Besold, T. R.; Schorlemmer, M.; and Smaill, A., eds., *Computational Creativity Research: Towards Creative Machines*, volume 7 of *Atlantis Thinking Machines*. Atlantis Press. 65–92.