Symposium Title:
Cognitive Processes and Computational Models of Creativity

Subject Areas: (choose max 3 within dropdown list from psychological science)
Cognitive Psychology, Methodology, Neuroscience

Symposium Abstract: (50 words)
The creative act is the ultimate achievement of the human cognitive system. But, does creativity involve processes that go beyond core cognitive processes? This symposium's presenters address the creative process from a cognitive perspective and introduce computational models that can account for different aspects of creative behaviour.

Supporting Summary: (500 words)
The creative process can be said to comprise a dynamic progression from problem analysis to idea generation, evaluation and implementation in order to produce products that are both novel and useful. Such a structured formulation of the creative process begs the question: "What's so special about creativity?". Does creativity involve processes that go beyond core cognitive processes recognized in intelligent behaviour? Or is the hallmark of one's creative ability merely defined by one's knowledge structure and search strategy herein? The four presenters in this symposium address which cognitive processes are involved in creativity and propose computational models to understand *how* people come up with creative ideas and products.

Creativity is related to intelligence and creative acts clearly lean on executive processes. Our first speaker, Emanuel Jauk, addresses how executive processing components influence creative performance – especially the role of inhibition in creative ideation. Can one's ability to come up with creative ideas be largely explained by basic cognitive processes such as attention and executive control?

The second and third speaker consider creative ideation as a search process for possible solutions in semantic memory. Take, for example, a non-creative fluency task in which one must think of as many animals as possible. People tend to generate solutions in clusters – first pets (e.g., cat, dog), then farm animals (e.g., cow, horse) and then perhaps zoo animals (e.g., giraffe, elephant).

Our second speaker, Mathias Benedek, addresses the roles of semantic memory structure and executive control in the ability to come up with *creative* ideas. His work indicates that more creative people have more clustered semantic networks and are better at broad memory search.

Our third speaker, Eddy Davelaar, examines how creative insights can be considered a non-systematic search within a vast space of possibilities. However, in the Remote Associates Task he uses to demonstrate his theory, there are multiple cues (cottage, swiss, cake) and one solution (cheese). As such the task constraints change the search process. He challenges the view of cluster-like search and proposes that insight and creativity are executive components of long-term knowledge storage and retrieval.

Our fourth speaker, Ron Sun, introduces a computational implementation of the Explicit-Implicit Interaction theory. This theory of creative problem solving relies mainly on five basic principles: 1)

the co-existence of and the difference between explicit and implicit knowledge; 2) the simultaneous involvement of implicit and explicit processes in most tasks; 3) the redundant representation of explicit and implicit knowledge; 4) the integration of the results of explicit and implicit processing; and 5) iterative (and possibly bidirectional) processing. Sun and Helie have developed a formalisation of process-based theories of creativity that encompasses incubation, insight, and related phenomena.

Finally, our discussant addresses the validity of these paradigms by contrasting people's performance on creative ideation, creative insight, creative judgement and verbal fluency tasks to ascertain whether creative tasks involve unique component processes or merely reflect a combination of well-structured domain knowledge and intelligence, including executive processes. In other words, we discuss whether there is "anything special" about creativity.

1st Chair:
Claire Stevenson, University of Amsterdam

2nd Chair:
Han van der Maas, University of Amsterdam

Discussant:
Claire Stevenson, University of Amsterdam

Presenter 1:

Name:
Emanuel Jauk

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Topic:
Creativity, Attention, and Executive Control

Presentation abstract (50 words):
Attention and executive functions are crucial to creative idea generation. Yet, their functional role for different facets of creativity is not fully understood. The presented empirical work focuses on the degree to which attentional and executive components influence the creative process at different levels of analysis.

Co-authors:
Markus Thaler, Mathias Benedek, Aljoscha C. Neubauer (University of Graz)

Presenter 2:

Name:
Mathias Benedek

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Topic:
The role of semantic network structure and cognitive ability for creative thought

Presentation abstract (50 words):
This study tested associative and executive theories of creativity. We modelled individual semantic memory structure with a novel method based on semantic relatedness judgments, and analysed them with network science metrics. Creativity was predicted by broad retrieval ability and by network structure for specific methods of network filtering.

Co-authors:
Emanuel Jauk (University of Graz), Yoed Kenett (University of Pennsylvania)

Presenter 3:

Name:
Eddy J. Davelaar

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Topic:

Presentation abstract (50 words):
The remote associates test (RAT) has been associated with insight, creativity, and semantic search. In this talk, I take a memory perspective and outline a theory (with data and computational model) that integrates insight and creativity as executive components involved in control of long-term knowledge.

Co-authors:

Presenter 4:

Name:
Ron Sun

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Topic:
Accounting for creativity within a unified framework

Presentation abstract (50 words):
We propose a unified framework for understanding creative problem solving that explains incubation, insight, and various related phenomena. Here we present a computational implementation of the Explicit-Implicit Interaction theory that was developed based on the CLARION cognitive architecture and simulates much relevant human data.

Co-authors:
Sebastien Helie (Purdue University)