ISEA 2020

MEASURING COMPUTATIONAL CREATIVITY: COLLABORATIVELY DESIGNING METRICS TO EVALUATE CREATIVE MACHINES

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WELCOME! :D

WE UNDERSTAND WE CANNOT MEASURE EVERY ASPECT OF CREATIVITY BUT WE WANT TO FIGURE OUT THE MEASURABLE ASPECTS OF CREATIVITY

WE ARE HERE FOR

- Collectively brainstorming evaluation metrics and producing a set of metrics.
- Creating a map of metrics to help us have a better view on the problem
- Building a community that contributes to this difficult task

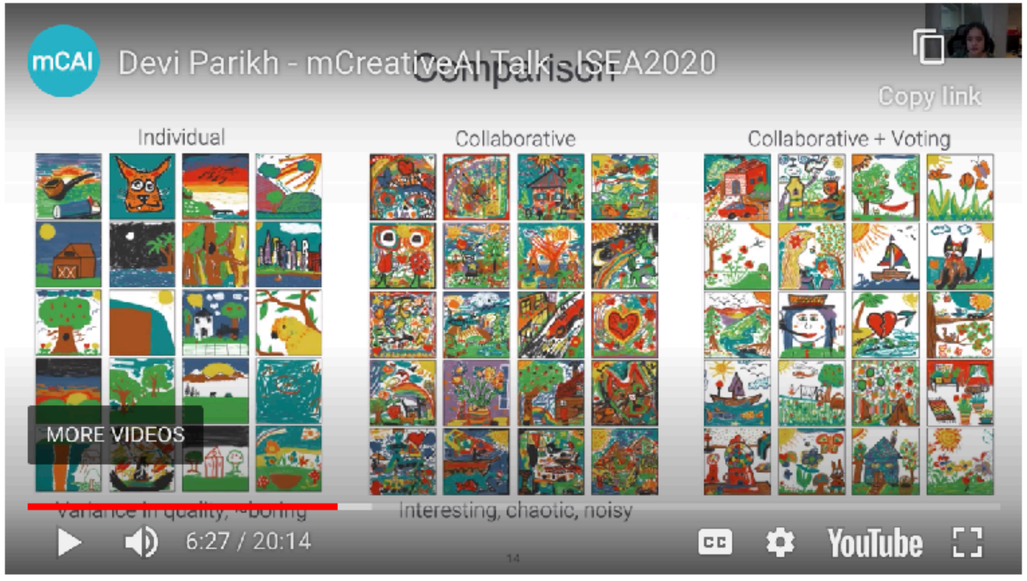
OUR SCHEDULE TODAY IS

- Introduction (20 min)
- Small group discussion: Elements of creative AI (30 min)
- Sharing the first discussion results (15 min)
- Invited speaker panel 1 (35 min)
- Small group discussion 2: Evaluating selected projects (30 min)
- Sharing the second discussion results (15 min)
- Invited speaker panel 2 (35 min)
- Small group discussion 3: Revising metrics, evaluating the second project (30 min)
- Presentation of results and Q&A (30 min)
- 5 min breaks as needed

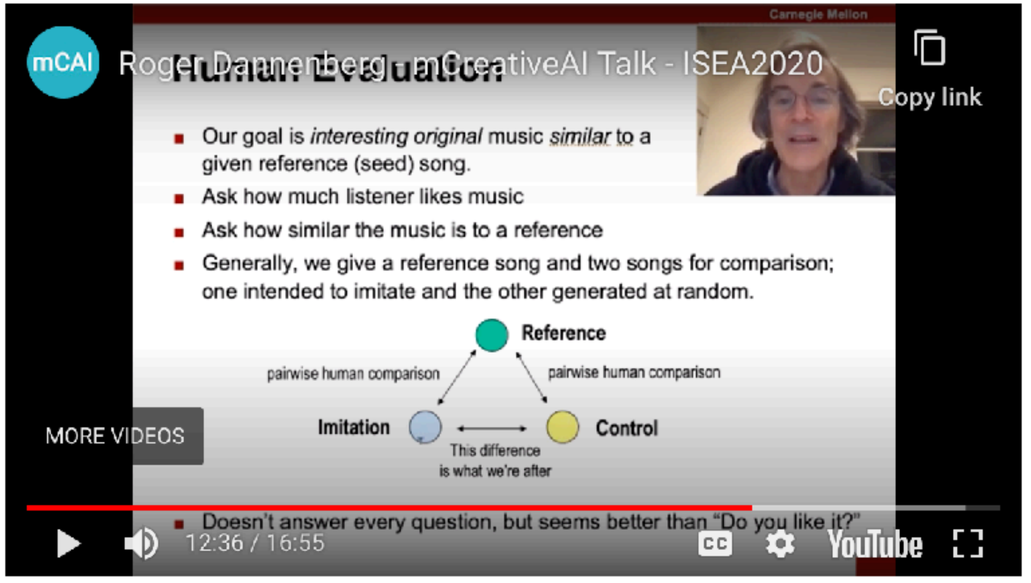
Allison Parrish (New York University, decontextualize.com)

Aaron Hertzmann (Adobe Research)

Devi Parikh (Georgia Tech/Facebook AI Research)



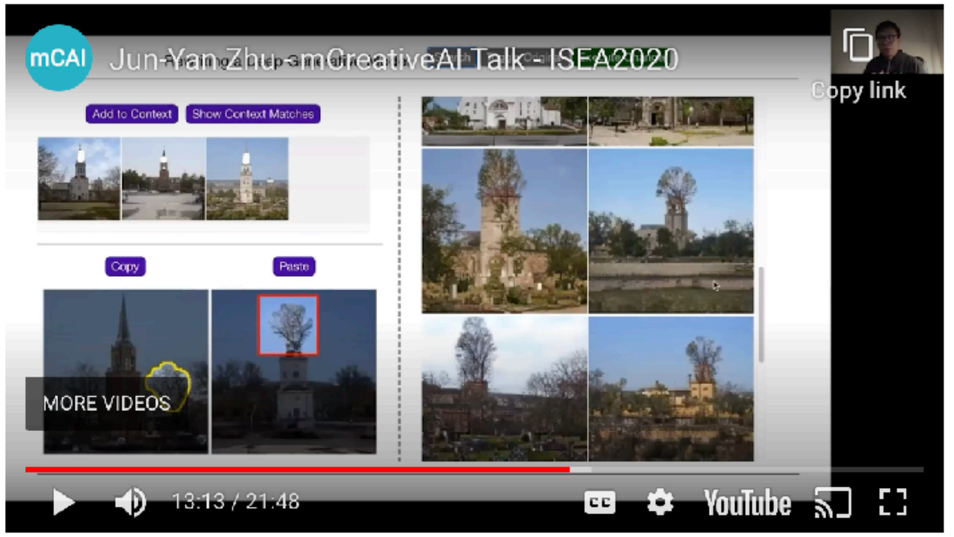
Roger Dannenberg (Carnegie Mellon University)



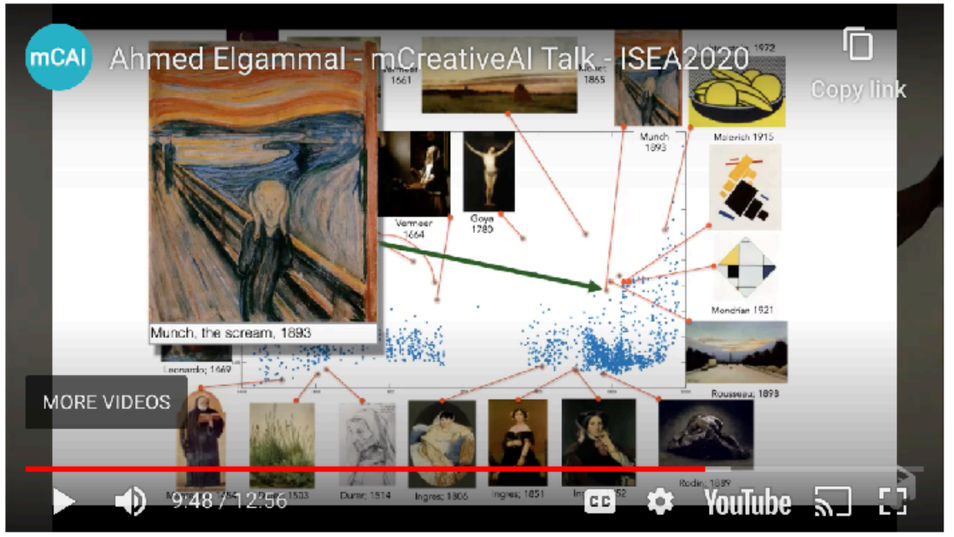
Fabrizio Poltronieri (Institute of Creative Technologies at De Montfort UNiversity, fabriziopoltronieri.com)

Haru Ji (OCAD University, artificialnature.net/) and **Graham Wakefield** (York University, artificialnature.net)

Jun-Yan Zhu (Carnegie Mellon University)



Ahmed Elgammal (Rutgers University)



PANEL DISCUSSIONS BY INVITED SPEAKERS

Panel 1: Graham Wakefield, Haru Ji, Fabrizio Poltronieri, Allison Parrish, Aaron Hertzmann

- What are your methods and metrics for evaluating the creative AI system that you and your colleagues have developed?
- How does the study of creative AI systems inform human creative practice?
- How do we attribute (who is responsible for) the creativity in collaborative creative systems?
- Do you think there is a difference between creative AI and human creativity? What would be the difference? If not, why not.

PANEL DISCUSSIONS BY INVITED SPEAKERS

Panel 2: Ahmed Elgammal, Devi Parikh, Jun-Yan Zhu, Roger Dannenberg

- What are your methods and metrics for evaluating the creative AI system that you and your colleagues have developed?
- Do human creative methods provide valuable models for computational creativity? How does human creativity influence computational creativity?
- How do we attribute (who is responsible for) the creativity in collaborative creative systems?
- How would you define creativity in generative models? If these models are specifically trained to generate new content, does this mean that they are necessarily creative?

MORE QUESTIONS

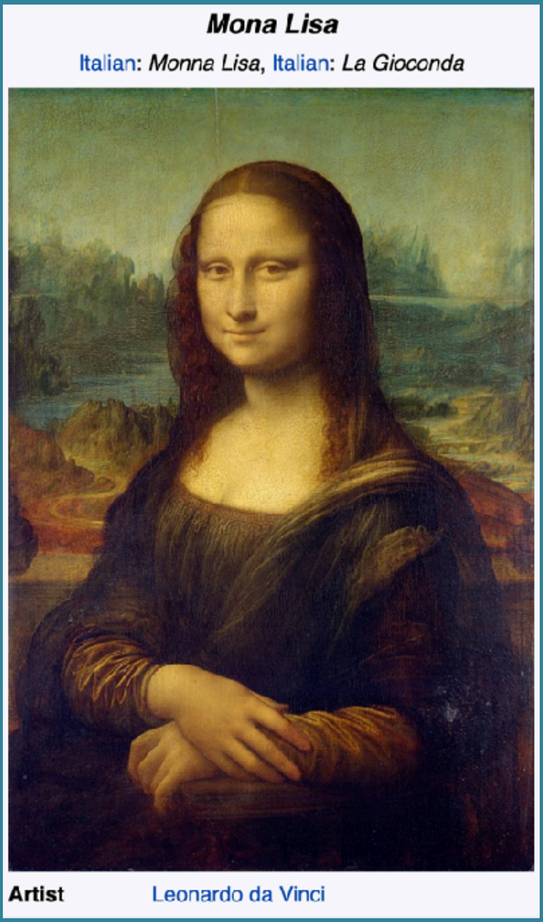
- Are all generative systems "creative"? or… Is there a meaningful distinction between generativity and creativity?

- How can we contribute to a better definition of "creativity" (which is still fuzzy) using measures that capture computational creativity?

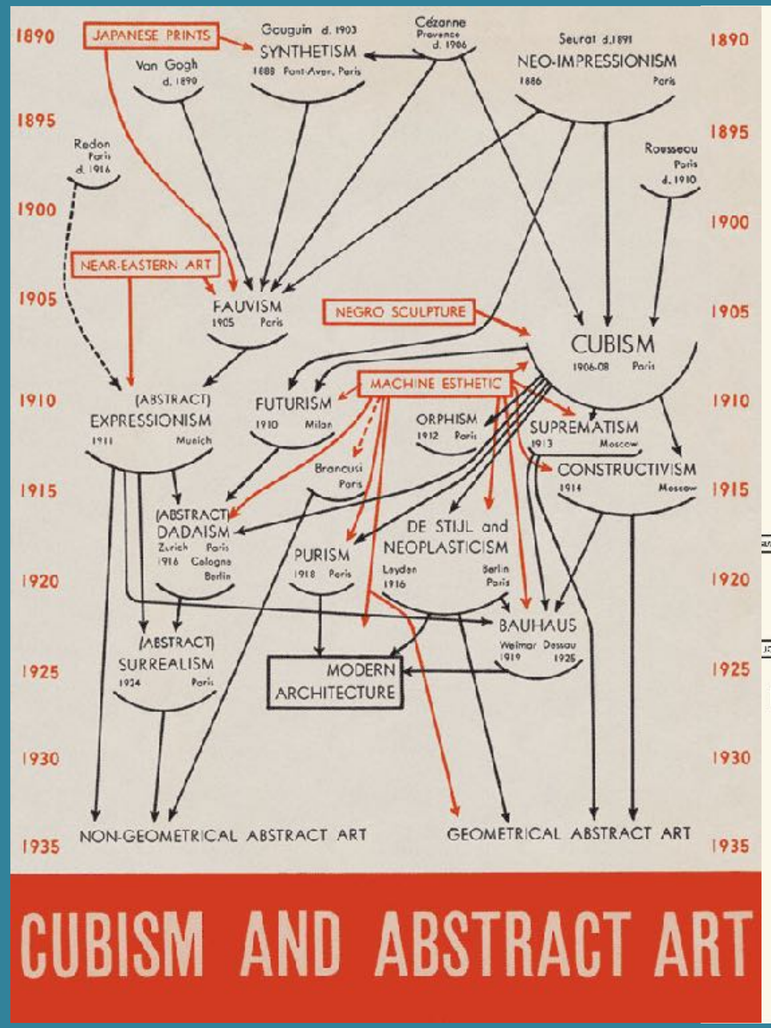
- Evaluating a creative work can be considered subjective. Can we (and should we) account for this subjectivity in our artificially intelligent evaluation methods, or should we strive to make objective measures?

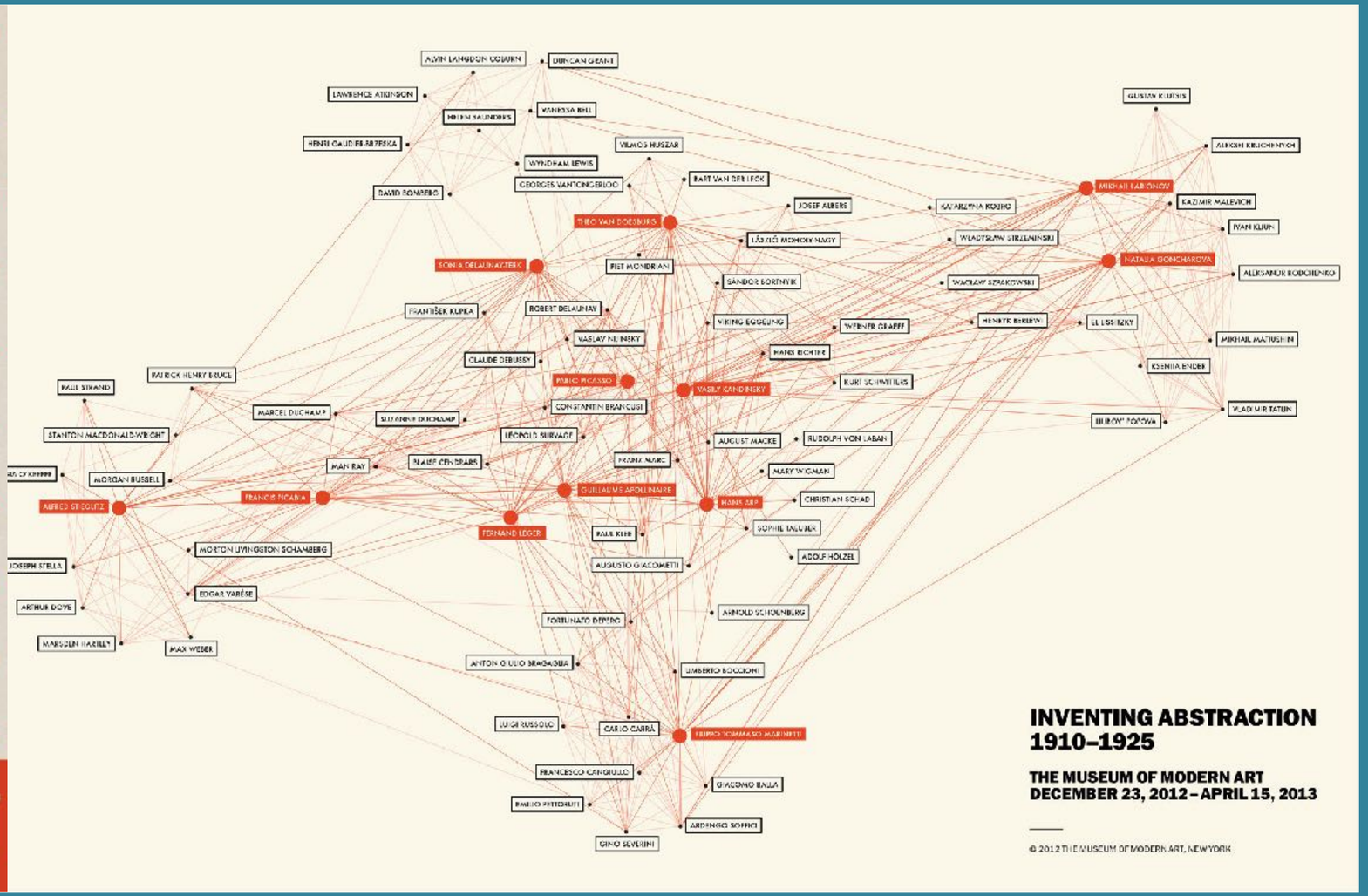
IS THIS CREATIVE?

CREATIVITY IS NOT A SUDDEN BURST OUT OF BLANK SPACE: FROM REPRESENTATIONAL(FIGURATIVE) ART TO ABSTRACT ART



CREATIVITY IS NOT A SUDDEN BURST OUT OF BLANK SPACE: CUBISM AND ABSTRACT ART





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CREATIVITY THEORY

CREATIVITY

- “creativity involves a multitude of definitions, conceptualizations, domains, disciplines that bear on its study, empirical methods, and levels of analysis, as well as research orientations that are both basic and applied - and applied in varied contexts.”

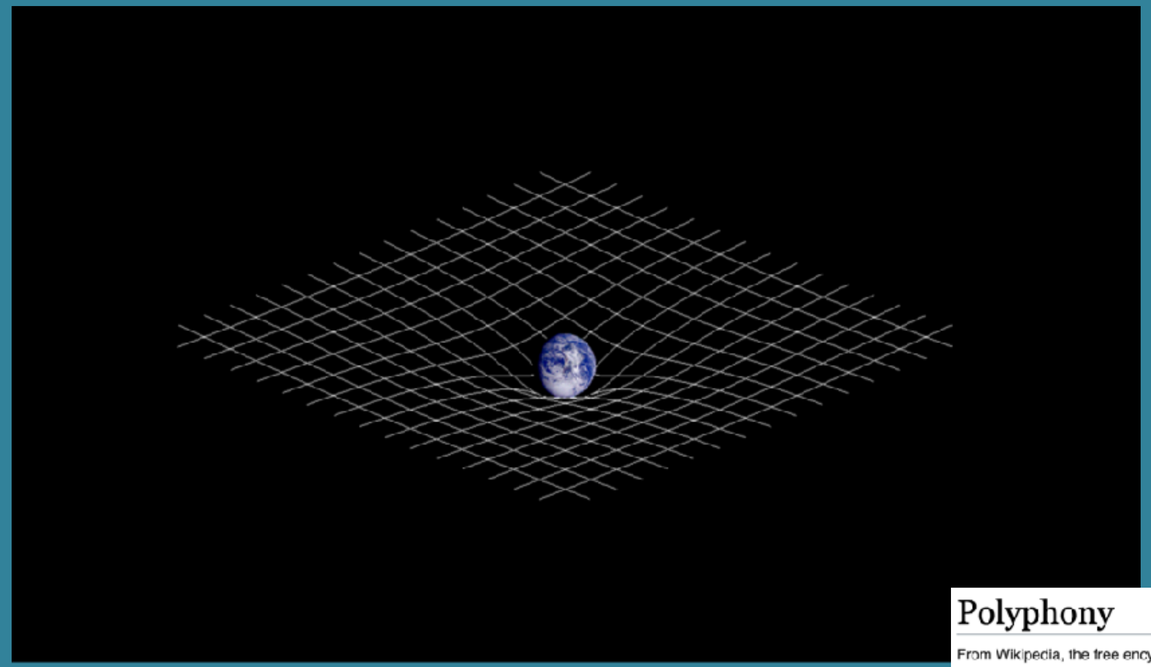
JAMES C. KAUFMAN ET AL, THE CAMBRIDGE HANDBOOK OF CREATIVITY, 2010, CAMBRIDGE U?NIVERSITY PRESS

CATEGORIES OF CREATIVE MAGNITUDE

- **Eminent creativity**: "**Big-C** Creativity refers to unambiguous examples of creative expression.
- **Everyday creativity**: "**Little-c** creativity focuses on the creativity of everyday life - experiences and expressions accessible to most anyone, for example, the novel way a home cook includes ingredients in a recipe, which is later. Praised by family and friends.
- "The **mini-c** category helps differentiate the subjective and objective forms of little c creativity; making room for the more subjective or personal, internal, or mental or emotional forms of creativity.
- "**Pro-c** makes room for professional-level creators like professional artists who have not yet attained eminent status, but who are well beyond little-c creators in knowledge, motivation, and performance."

JAMES C. KAUFMAN ET AL, THE CAMBRIDGE HANDBOOK OF CREATIVITY, 2010, CAMBRIDGE U?NIVERSITY PRESS

EMINENT CREATIVITY EXAMPLES



Polyphony

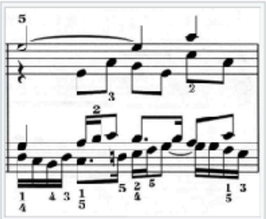
From Wikipedia, the free encyclopedia

This article is about the musical texture. For other uses, see Polyphony (disambiguation).

In music, **polyphony** is one type of musical texture, where a texture is, generally speaking, the way that melodic, rhythmic, and harmonic aspects of a musical composition are combined to shape the overall sound and quality of the work. In particular, **polyphony** consists of two or more simultaneous lines of independent melody, as opposed to a musical texture with just one voice, monophony, or a texture with one dominant melodic voice accompanied by chords, which is called homophony.

Within the context of the Western musical tradition, the term polyphony is usually used to refer to music of the late Middle Ages and Renaissance. Baroque forms such as fugue, which might be called polyphonic, are usually described instead as contrapuntal. Also, as opposed to the *species* terminology of counterpoint,[clarification needed] polyphony was generally either "pitch-against-pitch" / "point-against-point" or "sustained-pitch" in one part with melismas of varying lengths in another.[1] In all cases the conception was probably what Margaret Bent (1999) calls "dyadic counterpoint",[2] with each part being written generally against one other part, with all parts modified if needed in the end. This point-against-point conception is opposed to "successive composition", where voices were written in an order with each new voice fitting into the whole so far constructed, which was previously assumed.

The term *polyphony* is also sometimes used more broadly, to describe any musical texture that is not monophonic. Such a perspective considers homophony as a sub-type of polyphony.[3]



A bar from J.S. Bach's "Fugue No.17 in A flat", BWV 862, from *Das Wohltemperierte Clavier* (Part I), a famous example of **contrapuntal polyphony**. Play (help·info)

RELEVANT THEORIES OF CREATIVITY (4 OUT OF 10)

- **Problem Solving & Expertise-Based**: Creative solutions to ill-defined problems result from a rational process, which relies on general cognitive processes and domain expertise (Little-c to Big-C)
- **Problem Finding**: Creative people proactively engage in a subjective and exploratory process of identifying problems to be solved (Primarily Mini-C)
- **Evolutionary** (Darwinian): Eminent creativity results from the evolutionary-like processes of blind generation and selective retention (Primarily Big-C)
- **Typological**: Creators vary along key individual differences, which are related to both macro- and micro-level factors and can be classified via typologies. (Little-c to Big-C)

JAMES C. KAUFMAN ET AL, THE CAMBRIDGE HANDBOOK OF CREATIVITY, 2010, CAMBRIDGE U?NIVERSITY PRESS

COMPUTATIONAL CREATIVITY

COMPUTATIONAL CREATIVITY: GENERAL (AND ARGUABLE) PERSPECTIVE FROM THE ASSOCIATION FOR COMPUTATIONAL CREATIVITY

"The goal of computational creativity is to model, simulate or replicate creativity using a computer, to achieve one of several ends:

to construct a program or computer capable of human-level creativity

to better understand human creativity and to formulate an algorithmic perspective on creative behavior in humans

to design programs that can enhance human creativity without necessarily being creative themselves"

COMPUTATIONAL CREATIVITY, WIKIPEDIA, HTTPS://EN.WIKIPEDIA.ORG/WIKI/COMPUTATIONAL_CREATIVITY

COMPUTATIONAL CREATIVITY BY NEWELL, SHAW, SIMON (1958, CARNEGIE INSTITUTE OF TECHNOLOGY)

"we call problem solving creative when the problems solved are relatively new and difficult"

A. NEWWLL ET AL, THE PROCESSES OF CREATIVE THINKING, 1958, SYMPOSIUM ON CREATIVE THINKING

COMPUTATIONAL CREATIVITY BY NEWELL, SHAW, SIMON (1958, CARNEGIE INSTITUTE OF TECHNOLOGY)

"1. Completely operational specifications (programs) for the behavior of mechanisms (or organisms) that, with appropriate initial conditions, would in fact think creatively; "

"2. a demonstration that mechanisms behaving as specified (by these programs) would exhibit the phenomena that commonly accompany creative thinking (e.g., incubation, illumination, formation and change in set, etc.);

"3. a set of statements - verbal or mathematical - about the characteristics of the class of specifications (programs) that includes the particular examples specified."

A. NEWWLL ET AL, THE PROCESSES OF CREATIVE THINKING, 1958, SYMPOSIUM ON CREATIVE THINKING

COMPUTATIONAL CREATIVITY BY NEWELL, SHAW, SIMON (1958, CARNEGIE INSTITUTE OF TECHNOLOGY)

"Problem solving is called creative to the extent that one or more of the following conditions are satisfied:

1. The product of the thinking has novelty and value (either for the thinker or for his culture).

2. The thinking is unconventional, in the sense that it requires modification or rejection of previously-accepted ideas.

3. The thinking requires high motivation and persistence: either taking place over a considerable span of time (continuously or intermittently), or occurring at high intensity.

4. The problem as initially posed was vague and ill-defined, so that part of the task was to formulate the problem itself. "

A. NEWWLL ET AL, THE PROCESSES OF CREATIVE THINKING, 1958, SYMPOSIUM ON CREATIVE THINKING

COMPUTATIONAL CREATIVITY BY NEWELL, SHAW, SIMON (1958, CARNEGIE INSTITUTE OF TECHNOLOGY)

- "**Is Unconventionality Enough?**"

- "If unconventionality simply means rejecting some of the heuristics that restrict search to a limited subspace, then the effect of unconventionality will generally be a return to relatively **inefficient trial-and-error search in a very much larger space**."

- "attention to **the richness of their systems of heuristics** (that makes any particular piece of heuristic dispensable, and to their learning processes that generate new heuristics to fill the vacuums created by the rejection of the ones previously used.)"

A. NEWWLL ET AL, THE PROCESSES OF CREATIVE THINKING, 1958, SYMPOSIUM ON CREATIVE THINKING

MODELING CREATIVITY

COMPUTER MODELS OF CREATIVITY
BY MARGARET A. BODEN (2009)

"Creativity isn't magical. It's an aspect of normal human intelligence, … Whether computers could "really" be creative isn't a scientific question but a philosophical one, to which there's no clear answer. But we do have the beginnings of a scientific understanding of creativity."

BODEN, COMPUTER MODELS OF CREATIVITY, 2009, HTTPS://WWW.AAAI.ORG/OJS/INDEX.PHP/AIMAGAZINE/ARTICLE/VIEW/2254

COMPUTER MODELS OF CREATIVITY
BY MARGARET A. BODEN (2009)

- "**Combinational creativity** produces unfamiliar combinations of familiar ideas, and it works by making associations between ideas that were perviously only indirectly linked"

- "**Exploratory creativity** rests on some culturally accepted style of thinking, or "conceptual space. …The space is defined and constrained by a set of generative rules."

- "**Transformational creativity** … it can give rise to ideas that are not only new but fundamentally different from any that went before."

BODEN, COMPUTER MODELS OF CREATIVITY, 2009, HTTPS://WWW.AAAI.ORG/OJS/INDEX.PHP/AIMAGAZINE/ARTICLE/VIEW/2254

EXAMPLES FROM VISUAL ART

Nam June Paik
Zen for TV
1963

Meret Oppenheim
Object
Paris, 1936

The Listening Room

Artist	René Magritte
Year	1952
Medium	Oil on canvas
Dimensions	45 cm × 54.7 cm (18 in × 22 in)
Location	Menil Collection, Houston, TX

The Starry Night, June 1889. Museum of Modern Art, New York

MODELING CREATIVITY

- “both novel as well as high-quality in the domain”

LAV VARSHNEY IN THE VIDEO: AL AND THE ART OF INGENUITY: COMPUTATIONAL CREATIVITY, 2018 WORLD SCIENCE FESTIVAL, HTTPS://WWW.YOUTUBE.COM/WATCH?V=CZ1200KML4A&VL=EN

MODELING CREATIVITY IN AI

- How do we computationally model ambiguity?
- Would a novelty search result in valuable discoveries?
- Where is the threshold between randomness and creativity?
- How do we evaluate the creativity of an algorithm?

LAV VARSHNEY IN THE VIDEO: AL AND THE ART OF INGENUITY: COMPUTATIONAL CREATIVITY, 2018 WORLD SCIENCE FESTIVAL, HTTPS://WWW.YOUTUBE.COM/WATCH?V=CZ1200KML4A&VL=EN

HTTPS://MCREATIVEAI.GITHUB.IO

NOW! You Will Have Three Discussions In This Order

- First, brainstorming the elements of evaluation metrics
- Second, applying these metrics to existing AI artworks, to explore their utility
- Finally, revising your group's set of evaluation metrics.

After each 30 minute small group discussion, the representative from your group will present your results in the main room for 2-3 minutes.