

인공지능과 예술의 미래

11.16.2018 | 국회 미래연구원 금요 미래 세미나

여운승 Woon Seung Yeo

이화여자대학교 융합콘텐츠학과 Content Convergence

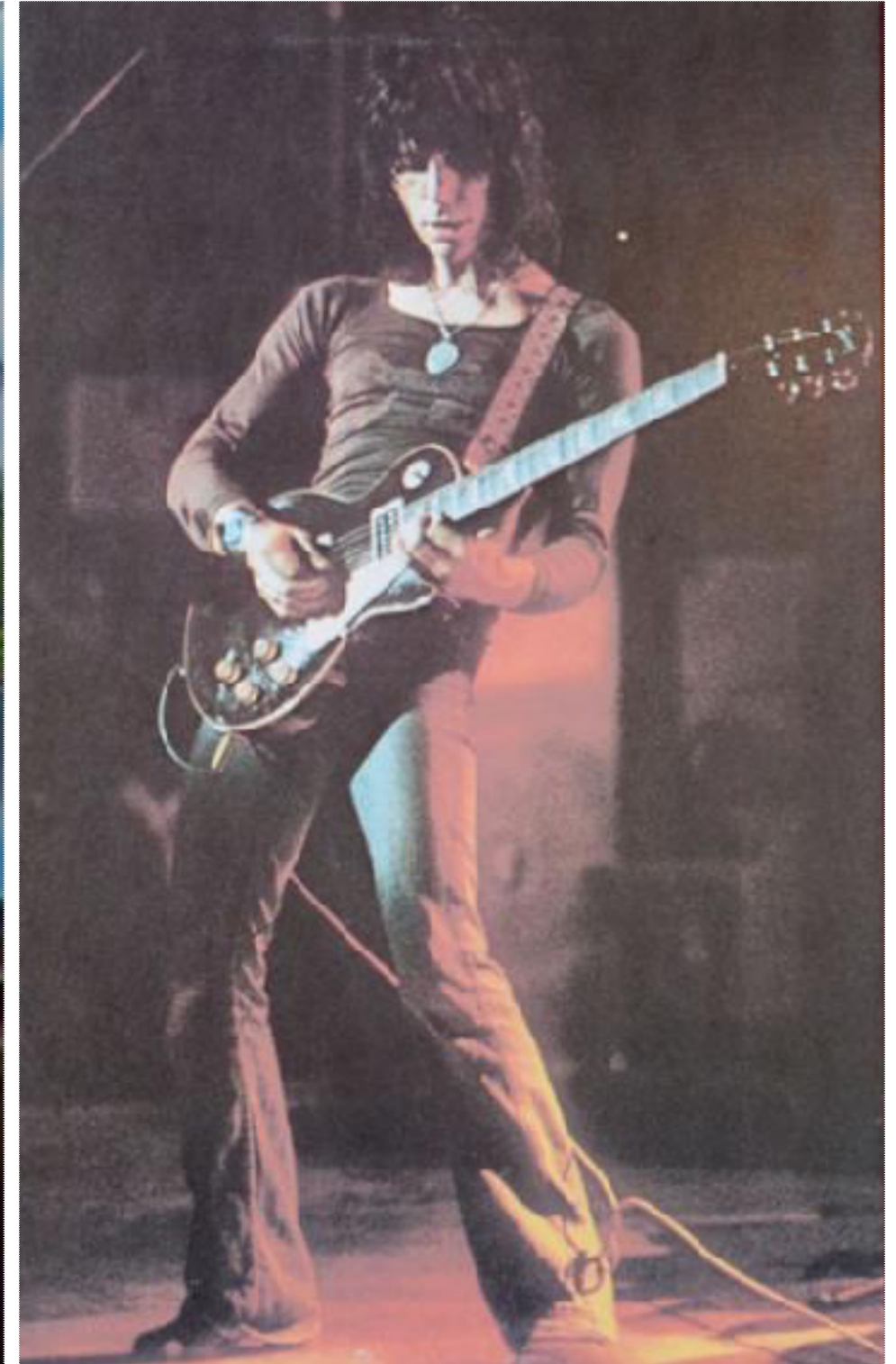
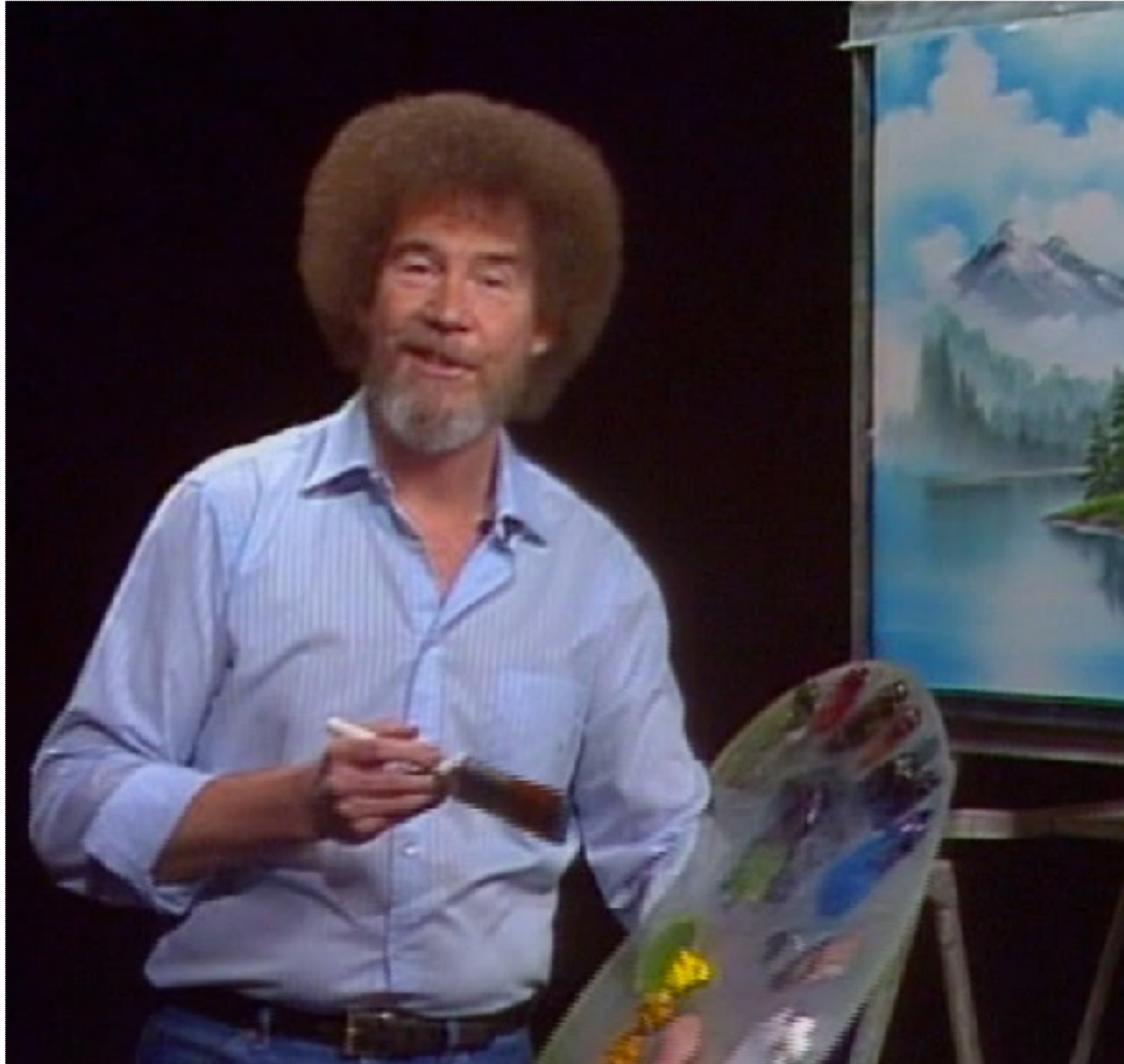
이화여자대학교 예술과학융합연구소 Ewha Arts and Science Institute

woony@ewha.ac.kr

예술 | 기술

art | technology

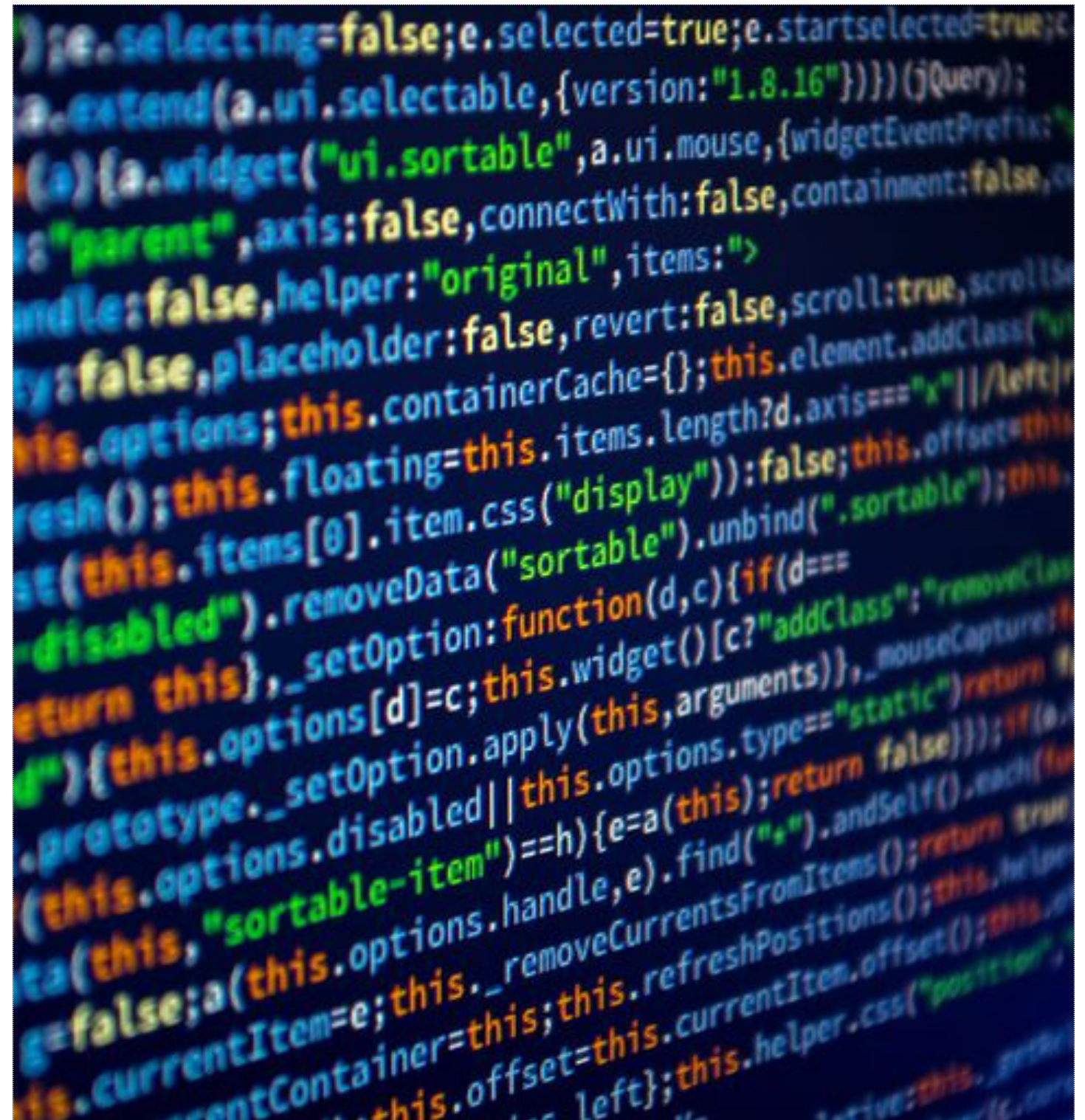
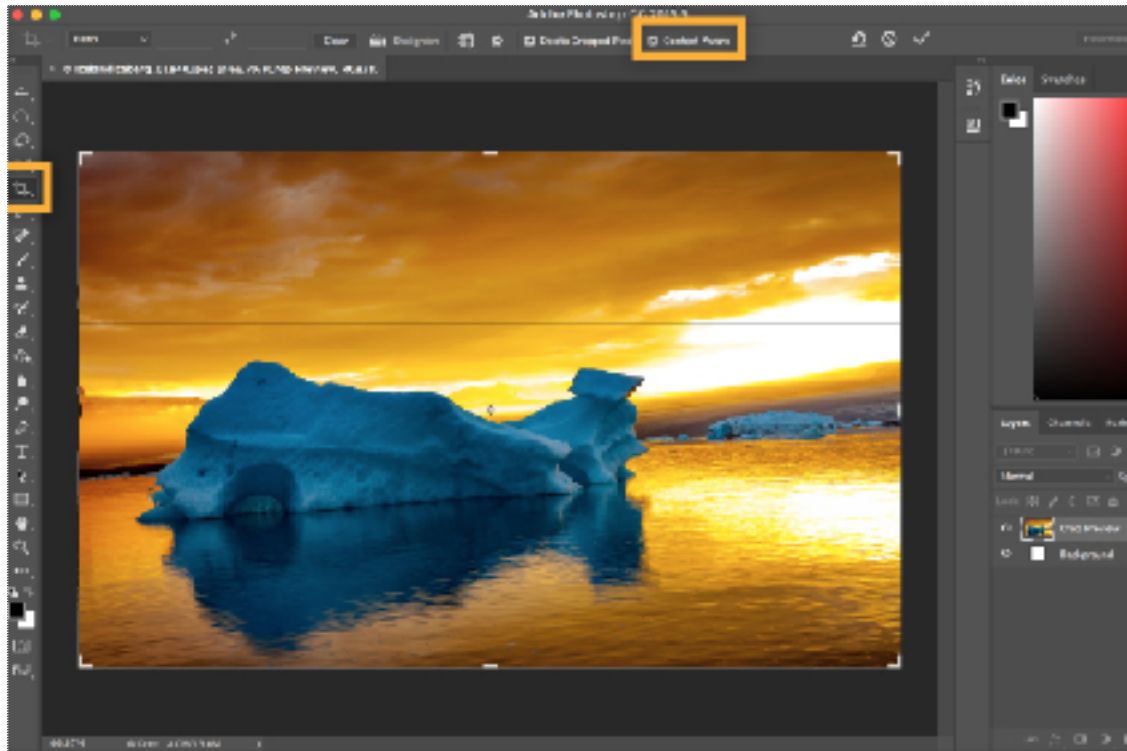
예술 창작 도구



<https://youtu.be/VlucWfTUo1A> | <https://goo.gl/2pZJS5>

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예술 창작 도구



4차 산업혁명과 예술

industry 4.0 & art

VR | AR | 3D printing



<https://goo.gl/images/zxSwE5> | <https://goo.gl/images/z7vUfY> | <https://goo.gl/images/KWnj3i>

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인공지능 예술 | AI art

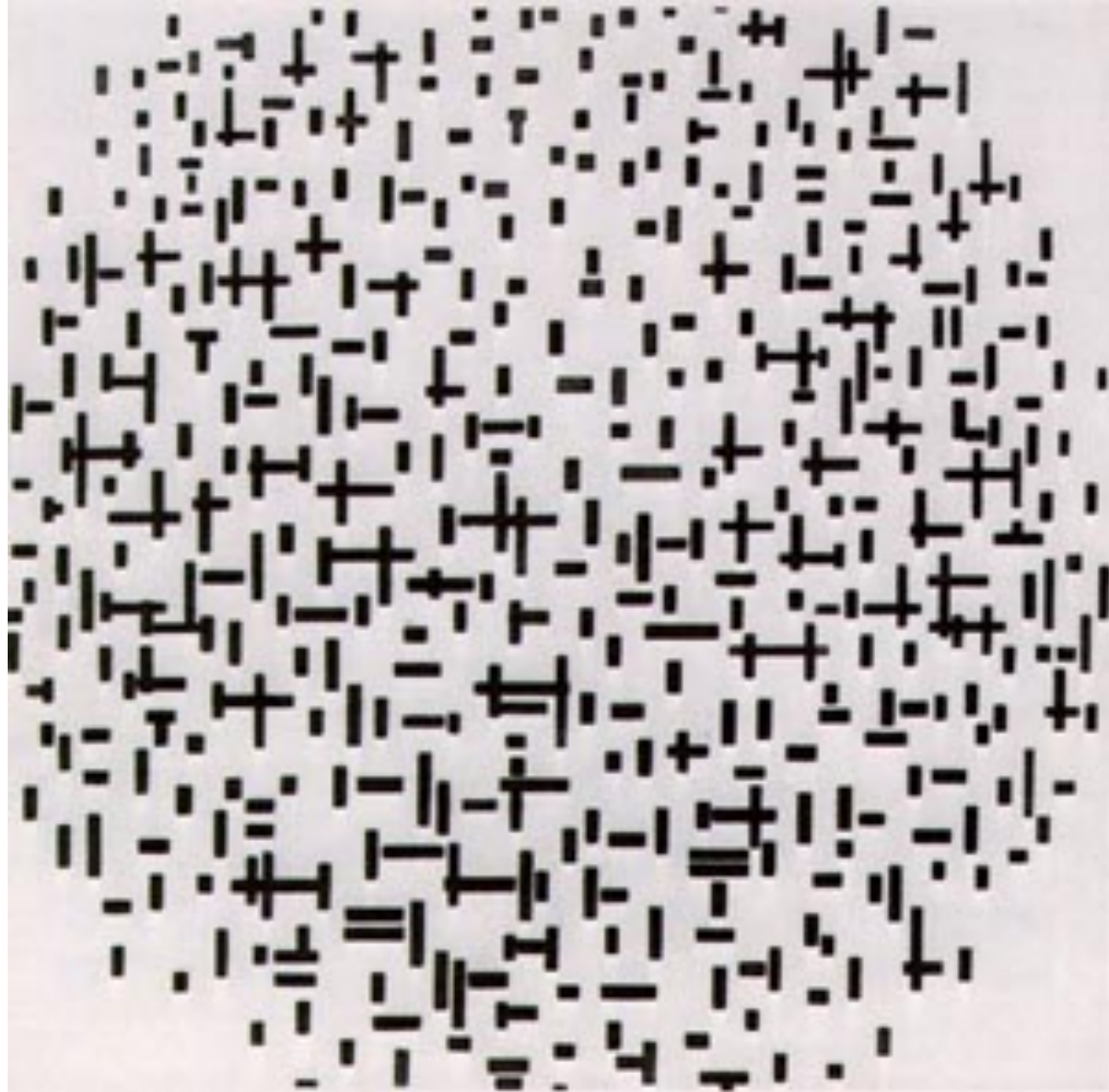


<https://goo.gl/images/BM8qrX>

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인간 | 기계

human or machine?



The Psychological Record, 1966, 16, 1-10.

HUMAN OR MACHINE: A SUBJECTIVE COMPARISON OF PIET MONDRIAN'S "COMPOSITION WITH LINES" (1917) AND A COMPUTER-GENERATED PICTURE

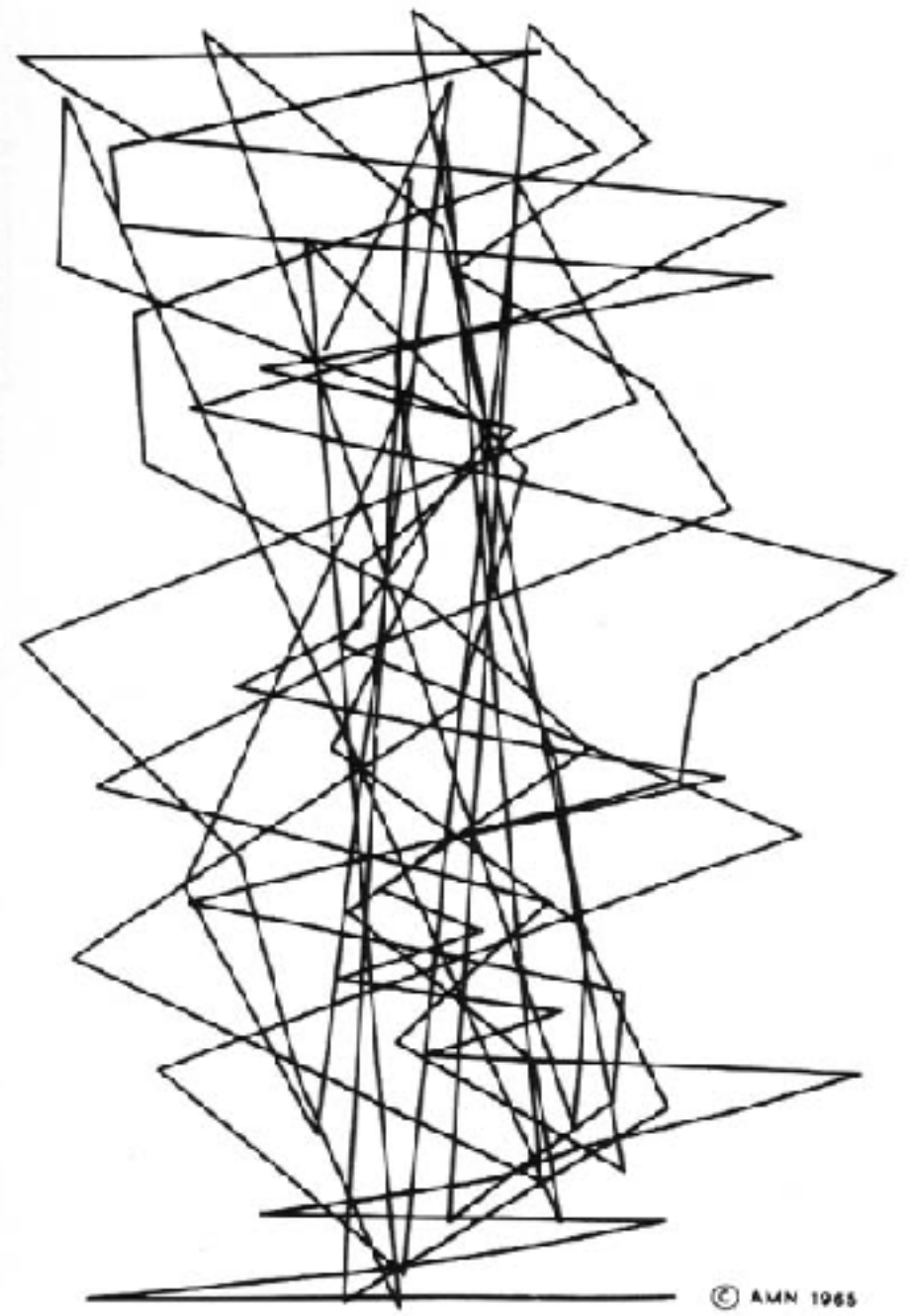
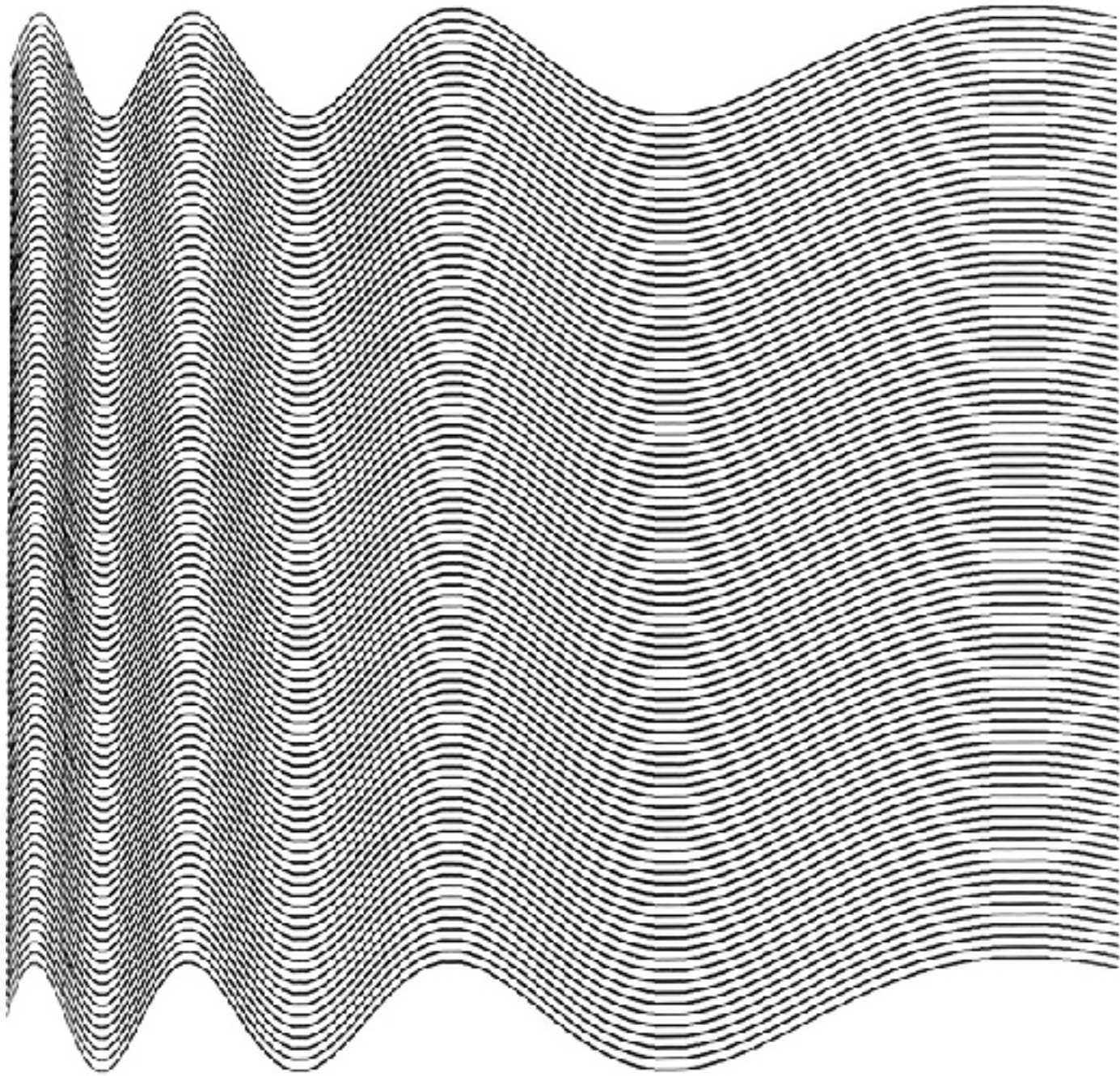
A. MICHAEL NOLL

*Bell Telephone Laboratories, Incorporated
Murray Hill, New Jersey*

A digital computer and microfilm plotter were used to produce a semirandom picture similar in composition to Piet Mondrian's painting "Composition With Lines" (1917). Reproductions of both pictures were then presented to 100 subjects whose tasks were to identify the computer picture and to indicate which picture they preferred. Only 28% of the Ss were able to correctly identify the computer-generated picture, while 59% of the Ss preferred the computer-generated picture. Both percentages were statistically different (0.05 level) from selections based upon chance according to a binomial test.

Piet Mondrian's "Composition With Lines"

In 1914 the Dutch painter Piet Mondrian (1872-1944) introduced a horizontal-vertical theme into his paintings which later culminated in the black-and-white painting "Composition With Lines" (1917). This abstract painting has been described by a prominent French critic and writer as "the most accomplished" of Mondrian's series of paintings based upon the horizontal-vertical theme (Seuphor, 1962). These



computer vs. Mondrian

- A. Michael Noll
 - ▶ <http://dam.org/artists/phase-one/a-michael-noll>
 - ▶ <http://www.citi.columbia.edu/amnoll/CompArtExamples.html>
- “Computer” Composition with Lines
 - ▶ computer for visual art
- 질문
 - ▶ 인간의 작품? 아니면 기계의 작품?
 - ▶ 예술? 아니면 기술?
 - ▶ 예술 창작은 인간 고유의 행위인가?
 - 무엇이 예술 창작을 인간 고유의 행위로 만드는가?


인공지능

AI | machine intelligence

AlphaGo



MATCH 1

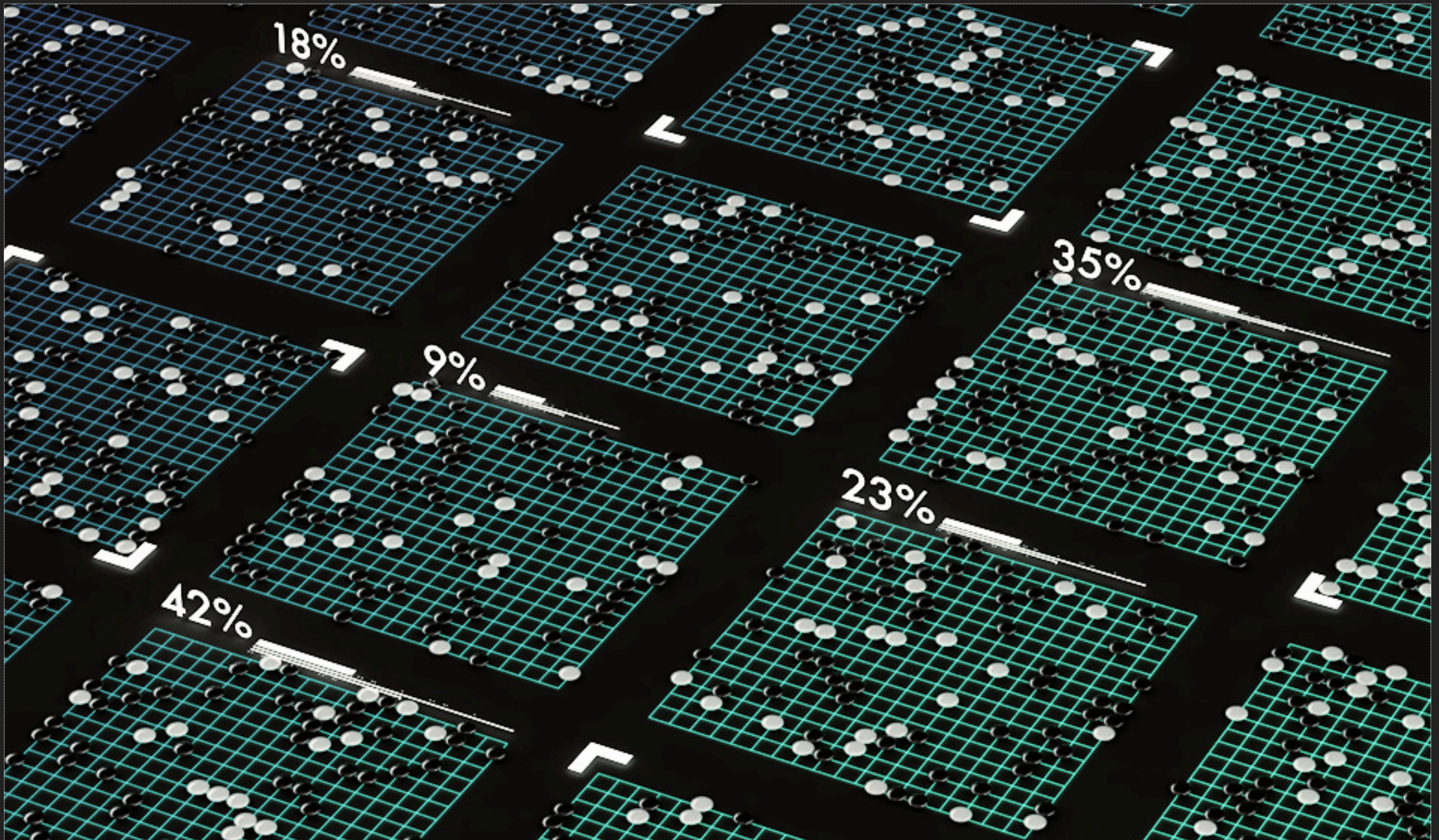
 AlphaGo vs Lee Sedol
Google DeepMind



<https://www.valuewalk.com/2016/03/google-ai-alphago-defeats-south-korean-go-master/>

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예상치 못한 발견



<https://www.quantamagazine.org/is-alphago-really-such-a-big-deal-20160329/>

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예상을 뛰어넘는 능력



<https://qz.com/639952/googles-ai-won-the-game-go-by-defying-millennia-of-basic-human-instinct/>

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strengthen

enlighten

frighten

artificial intelligence

- The ultimate goal of AI is to **understand man as a machine**.
- AI also aims to arrive at a general theory of intelligent action in **agents**: not just humans or animals, but individuals in the wider sense.
 - ▶ physical agent: robot
 - ▶ virtual or software agent: program inside a computer
- solving AI problem:
 - ▶ finding a way to build **machines with capabilities** on a par with, or beyond, those **found in humans**

closely related studies

- psychology
 - ▶ to understand the mental processes that underpin human and animal behavior
- cognitive science
- philosophy
 - ▶ shares some fundamental questions about (the existence of) human
 - ▶ ex: mind-body problem (Descartes)
 - computer program: mind
 - computer: brain
 - other mechanical parts: body

예술 | 음악

art | music

- 두산백과사전
 - ▶ 미적(美的) 작품을 형성시키는 **인간의 창조 활동**
- Webster's New World Dictionary (1984)
 - ▶ human creativity
- merriam-webster.com
 - ▶ skill acquired by experience, study, or observation

작곡 | 악보

- 일정한 질서에 따라 음을 조립, 음악작품을 창조하는 일
- 음표 (musical note)
 - ▶ pitch | duration (음고 | 길이) |
 - ▶ loudness | timbre...? (음량 | 음색)

2

arrangement pour deux pianos

de

John CAGE

♩ = 60

SOCRATE

Drame Symphonique en 3 Parties

I. Portrait de Socrate (Le Banquet)

Erik SATIE

OUVRAGE PROTÉGÉ
PHOTOCOPIER INTERDIT
Sans autorisation
du Centre National de la Recherche Scientifique
© Centre National de la Recherche Scientifique
1995

인공지능 예술

AI for art (or computational creativity?)

작곡가는...?



<http://artsites.ucsc.edu/faculty/cope/>

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songwriting machine (1950s)

New! A MACHINE THAT COMPOSES MUSIC



BUILD IT YOURSELF in a few hours!

Yes, you build any one of 34 exciting electric brain machines in just a few hours by following the clear-cut, step-by-step directions given in a thrilling booklet! No soldering required . . . no wiring beyond your skill! GENIAC is a genuine brain machine—not a toy. The only logic machine kit that not only adds, subtracts, etc., but presents the basic ideas of cybernetics, Boolean algebra, symbolic logic, automation, etc. So simple to construct that even a twelve-year-old can make a machine that will fascinate people with advanced scientific training! With the special circuitry of GENIAC, the Electric Brain Construction kit, you can compose tunes automatically. These new circuits were never available before!

OVER 400 COMPONENTS AND PARTS. Circuits operate on one flashlight battery, and the use of ingeniously designed parts makes building circuits one of the most fascinating things you've ever done! You set up problems in a variety of fields—and get your answers quicker than you can set them up! Play games with the machine—nim, tic-tac-toe, etc.—and pit your brain against its logic! Solves puzzles in a few seconds that would take you hours without the aid of the machine. You actually see how computing and problem-solving is analyzed with algebraic solutions transferred directly into circuit diagrams.

YOUR COST FOR GENIAC KIT: only \$19.95 postpaid. The 1958 Model GENIAC KIT contains: (1) a complete 100-page text, "Minds and Machines"—a basic introduction to computers. (2) "How to Construct Electrical Brains At Home"—a fully illustrated text book on basic computer design theory and circuits with specific instructions for building circuits. (3) Wiring Diagram Manual. A special booklet with full scale diagrams that you can tear out and place on your work bench for easy assembly. (4) Beginners' Manual. Starting from scratch, the manual adds extra experiments, thoroughly tested using GENIAC components to teach the basic symbols of electric circuits. (5) Over 400 components and parts.

So—mail the coupon for your GENIAC today! Your money back if not delighted!

Some Firms and Institutions that have ordered GENIAC:

Allis-Chalmers	Walter V. Clarke Associates	General Insurance Co. of America	Los Angeles Public Schools
Remington-Rand International Business Machines	Barnard College	Lafayette Radio Rohr Aircraft Co.	Kansas State University
Wheeldex Mfg. Co.	Westinghouse Electric	Albert Einstein Medical College	Duke University
Manuel Missionary College	Phillips Laboratories	Naval Research Laboratories	Coral Gables Bell Telephone Laboratories

Actual tune composed on GENIAC

COMPUTES, "REASONS" PLAYS GAMES

GENIAC ELECTRIC BRAIN

K1—Only \$19⁹⁵
 (Add \$1.00 W. of Miss. \$2.00 Outside U. S.)

Curtis Roads, *The Computer Music Tutorial*, MIT Press, 1996.

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new kid on the block



the next Rembrandt



<https://www.nextrembrandt.com>

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deep learning for photos (2017)



<https://ai.googleblog.com/2017/07/using-deep-learning-to-create.html>

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paradigm shift

질문 | questions

- 창의성이란 무엇인가? | what is creativity?
- 인간은 창의적인가? | are humans creative?
- 기계는 (컴퓨터는) 창의적일 수 있는가? | can machines be creative?
- 예술 창작에는 창의성이 필요한가? | does art require creativity?
 - ▶ 그러면 예술에서의 창의성이란 무엇인가? | if yes, what is creativity in art?
- 창의적인 인공지능의 시대에 | in the age of artificial creativity,
 - ▶ 예술 창작은 어떤 의미를 가지는가? | how can we define art?
 - ▶ 인간의 역할은 무엇인가? | what is our role in art?

새로운 예술 창작 패러다임의 등장

예술 창작 및 창의성의 새로운 정의는?

반응

public reaction

Initially hailed with enthusiasm, artificial intelligence, like all inventions, has since stirred up a storm of criticism.

Undoubtedly with the best intentions, certain minds see this admirable discovery as posing a danger for art; they were afraid lest the human hand might forget its skill, knowing that a machine exists that can do its work.

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- Théophile Gautier, 1857

수용 | 거부 | 무시

accept | reject | ignore

인공지능과 예술창작의 미래 예측

- 긍정적

- ▶ 새로운 예술 장르, 또는 표현 기법으로 수용
- ▶ 인간은 그에 적응하여 변화된 예술 생태계 창조

- 부정적

- ▶ 인간의 능력을 뛰어넘는 인공지능의 등장: 경쟁에서 도태
- ▶ 창작자로서의 인간은 더 이상 아무런 가치가 없는 상황

토론

some food for thought

셀카 (Selfies)



<https://goo.gl/images/qTwrXa> | <https://goo.gl/images/iqK2ef>

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Monkey steals camera to snap himself

A macaque monkey in Indonesia took a camera from a wildlife photographer before snapping himself in a variety of poses.



Image 1 of 2

The Sulawesi or crested black macaque is extremely rare and critically endangered Photo: David J Slater/Caters


The Telegraph

9:58PM BST 04 Jul 2011

How about that?

<https://goo.gl/yV5MQR>

분쟁의 시작



**WIKIMEDIA
COMMONS**

Main page
Welcome
Community portal
Village pump
Help center

Language select:
English
Select:

Participate
Upload file
Recent changes
Latest files
Random file
Contact us

Print/export
Download as PDF

Tools

What links here
Related changes
Special pages
Permanent link
Page information
Cite this page

English Not logged in Talk Contributions Create account Log in

File Discussion

View View source History

Search Wikimedia Commons



Wiki Loves Monuments: Photograph a monument, help Wikipedia and win!



File:Macaca nigra self-portrait (rotated and cropped).jpg



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to this file



Information
about reusing



<https://goo.gl/votu69>

분쟁의 심화



ANIMALS ARE NOT OURS
TO EAT, WEAR, EXPERIMENT ON, USE FOR
ENTERTAINMENT, OR ABUSE IN ANY OTHER WAY.▶



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Month, Tell TAMU to Stop Torturing
Dogs**

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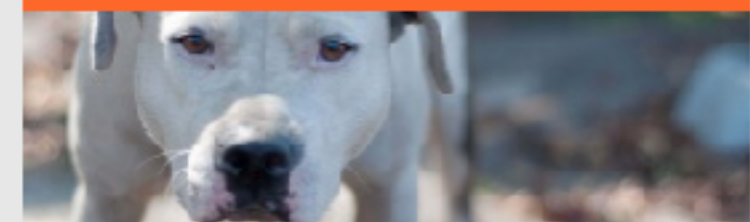
RENEW YOUR MEMBERSHIP

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Make a Donation



ANIMAL LIBERATION
THE TIME IS **NOW!** >



<https://www.peta.org>

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- 저작권은 "인간의 사상 또는 감정을 표현한 창작물"에 한정됨
 - ▶ "사람이 만든 창작물에만 저작권이 있다" (미 저작권청)
- 인공지능과 저작권
 - ▶ 인간이 아닌 존재의 창작능력 및 인격(?)에 대한 고민
 - ▶ 인공지능의 “창작”을 어떻게 정의할 것인가?
 - ▶ 또한 그 저작권을 어떠한 방식으로 인정할 것인가?

마지막 (?) 황제

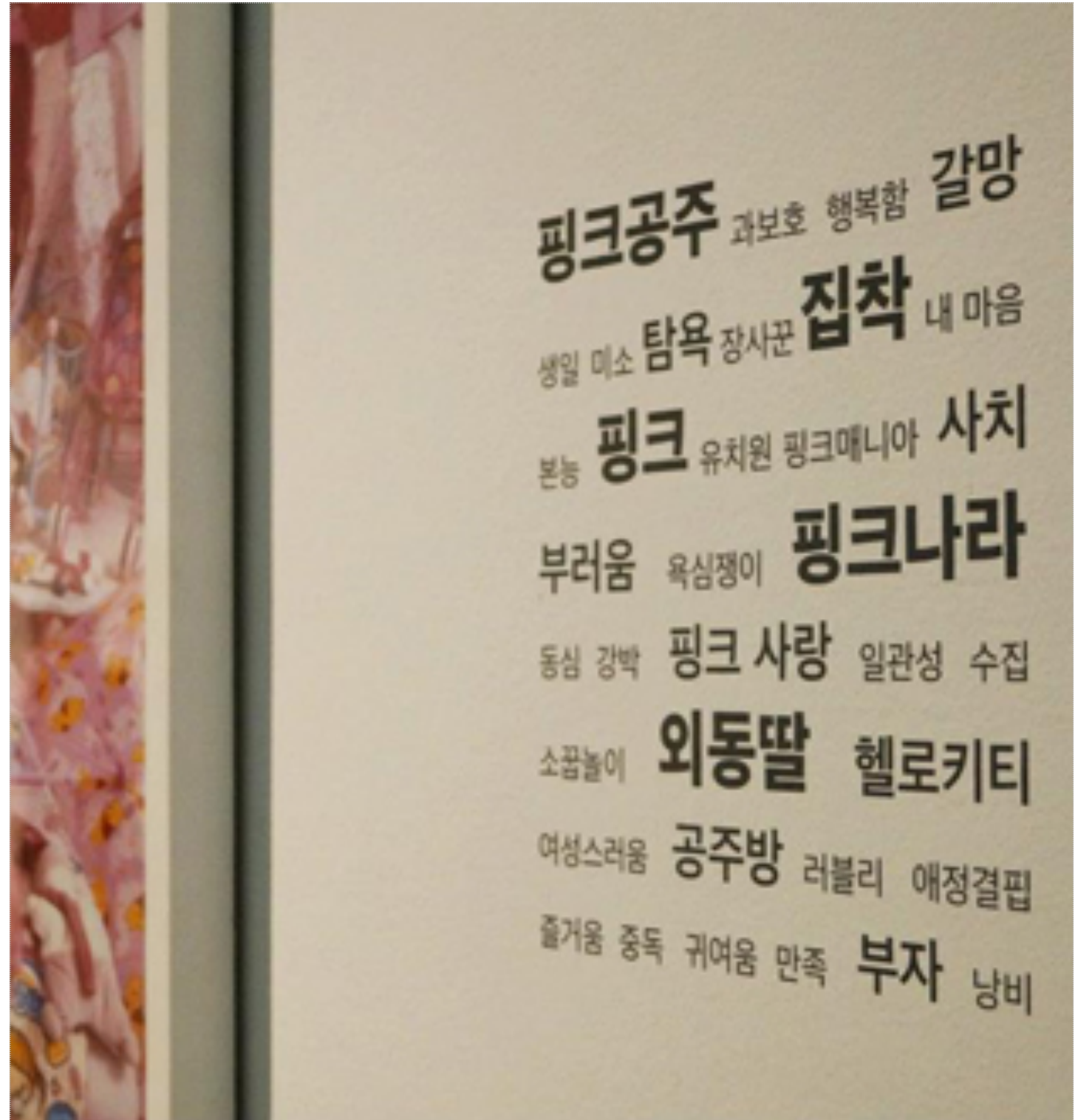


<https://goo.gl/WfYSwH> | <https://goo.gl/hLwP8v>

큐레이션

curation @ museums

social tagging



Tagging Art Works @ GMoMA, 2012. <https://neolook.com/archives/20121209f>

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crowd curation



Ewha 130 @ Ewha Univ. Museum, 2016. <https://goo.gl/4bi3bB> | <https://goo.gl/N56U3s>

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personalized curation

이화여자대학교박물관

관람객 참여전시

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160명의 관람객들이 큐레이터로 참여해주신 전시

〈당신을 큐레이터로 초대합니다!〉를 개막합니다.

참여전시는 박물관 소장품으로 꾸며진 도자기 전시장 곳곳에서 다양한 결과물로 볼 수 있으며, 나만을 위한 특별한 전시도 추천받을 수 있습니다.

큐레이터를 중심으로 이루어지던 전시에서 한 걸음 더 나아가 관람객과 진정한 소통을 위해 마련된 〈당신을 큐레이터로 초대합니다!〉에 많은 참여와 관심 부탁드립니다.

- 전시기간 | 2017. 7. 31 – 10. 31
- 전시장소 | 상설전시관 2관

큐레이터로 참여하신 분들

강규리	강인주	강서영	강신홍	강영일	강헌숙	경호순	고민선
곽삼근	곽소현	구소완	권민경	권민영	권희각	금지윤	김나정
김민지	김상화	김신우	김소진	김숙이	김순식	김영미	김용순
김유정	김윤화	김은주	김정민	김주연	김지영	김진경	김태광
김철영	김효영	김현규	김혜진	나선열	남진희	문기윤	민수인
박광무	박민경	박성희	박수진	박신희	박아빈	박영숙	박원영
박유진	박유찬	박윤진	박윤하	박재원	박주창	박지영	박진아
빅형숙	변규리	서민근	서세나	서을오	서현아	설아영	소유신
손민희	손수진	송수진	송채현	송호욱	신승인	신현신	안다혜
안유정	안지연	양비비	염고은	오송훈	오은채	오지예	오지현
왕티엔	유신혜	윤은옥	윤채원	윤혜정	이경열	이경희	이금행
이나경	이도은	이석민	이성실	이수진	이연순	이예은	이우정
이윤정	이정모	이정선A	이정선B	이정현	이주원A	이주원B	이종현
이지혜	이태순	이현우	임다연	임영옥	임지연	임채주	장길수
장윤정	장지희	장호진	전미숙	전은정	전일경	전진산	전진희
전태권	전희정	정다혜	정모정	정수연	정예원	정원연	정은숙
정지윤	정지은	정한조	조영석	조혜란	최경원	최수민	최윤정
최재희	최지윤	최혜주A	최혜주B	한수빈	한채을	한천구	홍훈기
황이숙	황정수	황효빈	무명 1인				

personalized curation



아아하다
예쁘다
단정하다
기품있다
멋있다
깔끔하다
조화롭다
문학적
여백의 미
아아하다
시적
지조
당당하다
절개
기개
고고하다
귀족적
간결하다
깨끗하다
아름답다
고급스럽다

관람객이 가장 좋아하는 도자기(별점 1위)

백자철화 매죽문 시명 향아리 | 조선 17세기

personalized curation



고급스럽다

절제미

안정적

수수하다

부드럽다

세련되다

단아하다
아하다
깨끗하다
아름답다
소박하다

깔끔하다

관람객 별점 2위

청자음각 연화문 병 | 고려 12세기

curator

information expert

curator

storyteller

curator

communicator

curator

social engineer

curator

educator / artist

Today's art exhibitions display objects which, at least for the traditional approach, have nothing to do with art... so why is this to be perceived as art?

Because what we see is the curator's choice.

When we visit an exhibition today, we are thus not directly observing works of art - what we are observing is the curator's notion of what art is; in short, the ultimate artist is not the producer but the curator, his/her activity of selection.

- Slavoj Žižek

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- Slavoj Žižek

algorithmic curation

is it legitimate?

알고리즘 작곡

algorithmic composition

이수대엽 (二數大葉)

1 ♩ = 20

노래
피
포

세피리

가야금

노래
피
이

세피리

가야금



from *SONG*

K-CMC 제2회 작곡발표회

2018. 9. 4 (화) 7:30pm 국립국악원 풍류사랑방

주최·주관 K-CMC 후원 이화여자대학교 한국음악과 

1. 12현 가야금을 위한 '알고리즘 0'

작곡 이로유
12현가야금_김유선

본 곡은 한국의 성악곡 중 '가곡(歌曲)'을 주제로 한 12현 가야금을 위한 작품이다. 여창가곡 15곡의 가야금 선율을 소재로 시간에 따른 징브 변화의 규칙을 나타내는 마코프 연쇄 (Markov chain) 모델 기반의 시음 생성 알고리즘을 디자인하고, 이를 활용하여 컴퓨터가 생성한 시음 정보를 바탕으로 일반적인 가곡의 장법 요소, 가야금의 기악적 요소 및 악기 본연의 시김음향 능률 고려하여 작곡, 완성하였다.

2. 정가와 대금, 거문고를 위한 '바라보아도'

작곡_유민희
성기_이선경 대금_김휘곤 거문고_송수연

정가와 대금, 거문고를 위한 '바라보아도'는 조선 중기의 기생이자 여류시인 매상(梅香)의 한시를 신석성 시인의 역본으로 노래한 곡이다. 성기가 가시고 있는 절세미와 매상의 시에 나타낸 그리움이 어우러져 깊은 서정성이 든 긴 노래이다. 가사에도 거문고라는 악기가 등장했지만 실제로 매창이 거문고를 다뤘다는 것에 의미를 두어 정가와 대금 거문고 3중주로 편성해 보았다.

3. 이별가

작곡 김명현
25현가야금1_김유선 25현가야금2_김바니

경기도민요 '이별가'는 일정한 장단이나 후렴없이 애절하고 길게 너뿔아 부르는 노래다. 박지원의 <한북행적록(漢北行稜錄)>에 의하면, 도중 진송 때 <어부사(漁父詞)>를 부르며 선유락을 추 뒤, 배가 떠나는 기적이 올리면 이기름이 <배따라기>를 불렀다고 하는데, 이 <배따라기>가 <이별가>와 시설이 유사하니 고한다. 이 노래를 모티브로 하여 25현가야금 두 대로 편성하여 세 구성해 보았다.

12현 가야금을 위한 알고리즘 0

작곡 이로운

The image displays a musical score for a 12-string gayageum, titled "알고리즘 0" (Algorithm 0) by Lee-roon. The score is written in a single system with five staves, all in treble clef. The key signature is three flats (B-flat, E-flat, A-flat), and the time signature is 4/4. The music consists of a continuous melodic line with various rhythmic patterns, including eighth and sixteenth notes, and rests. The score is divided into measures, with measure numbers 4, 7, 10, and 13 indicated at the beginning of their respective staves. The notation includes various note values, rests, and dynamic markings, such as accents and hairpins.

12현 가야금을 위한 알고리즘 0

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작곡 이로운

♩=70



감사합니다!

thanks a lot!