

Artificial Creativity

Can Robots Be Creative

What Is Creativity

Jonathan Kammerland

Alexander Reinthal



Bot or not?

Nailpolish

Swept off my feet shop till i drop, sequin sash

Angel food adore-a-ball, a -list

Ballet slippers barbados blue, big spender

Romper room rose bowl, resort fling

Innocent in stitches, island hopping

Nice as nice need a vacation, naughty nautical

Allure adore-a-ball, a-list



Bot or not?

Correct answer: Bot

Written by Nailpolish

<https://github.com/binn1e/nailpolish>

60 % say Bot

40 % say not



Bot or not?

Stanzas in Meditation

**She may count three little daisies very well
By multiplying to either six nine or fourteen
Or she can be well mentioned as twelve
Which they may like which they can like soon
Or more than every which they wish as a button
Just as much as they arrange which they wish
Or they can attire where they need as which say
Can they call a hat or a hat a day
Made merry because it is so**



Bot or not?

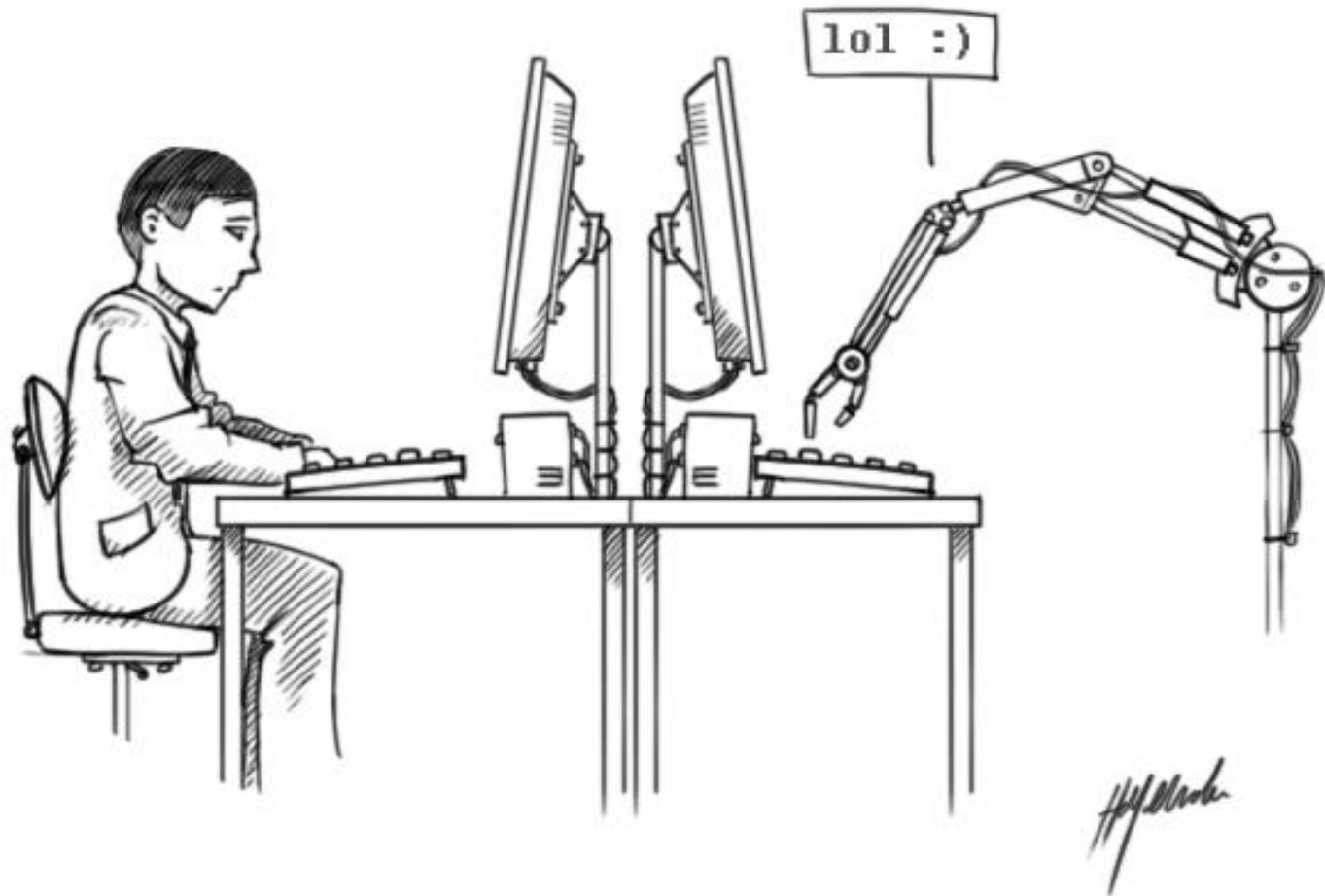
Correct answer: Not

Written by Gertrude Stein

60 % say Bot

40 % say not

A Poetry Turing Test



Reverse Turing Test: CAPTCHA

C ompletely

A utomated

T uring test to tell

C omputers and

H umans

A part



Reverse Turing Test: CAPTCHA



2013, CAPTCHAS beaten by Google and others
with 90% accuracy [2]

2014, CAPTCHAS by google and others with
99.8% accuracy [1]

Creativity is...



... the ability to perceive the world in new ways, find hidden patterns, to make connections between seemingly unrelated phenomena and generate new solutions.

Creativity is...



... a phenomenon whereby something new and somehow valuable is formed.



Creative Criteria

- ⦿ Autonomous Evaluation
- ⦿ Autonomous Change
- ⦿ Non-Randomness

Concepts introduced in an article about developing creativity in AI by Kyle E. Jennings [4]



Creativity Categories

- ⦿ Combinational
- ⦿ Exploratory
- ⦿ Transformational

Concepts introduced in an article about creativity in AI by
Margaret A. Boden [5]

1

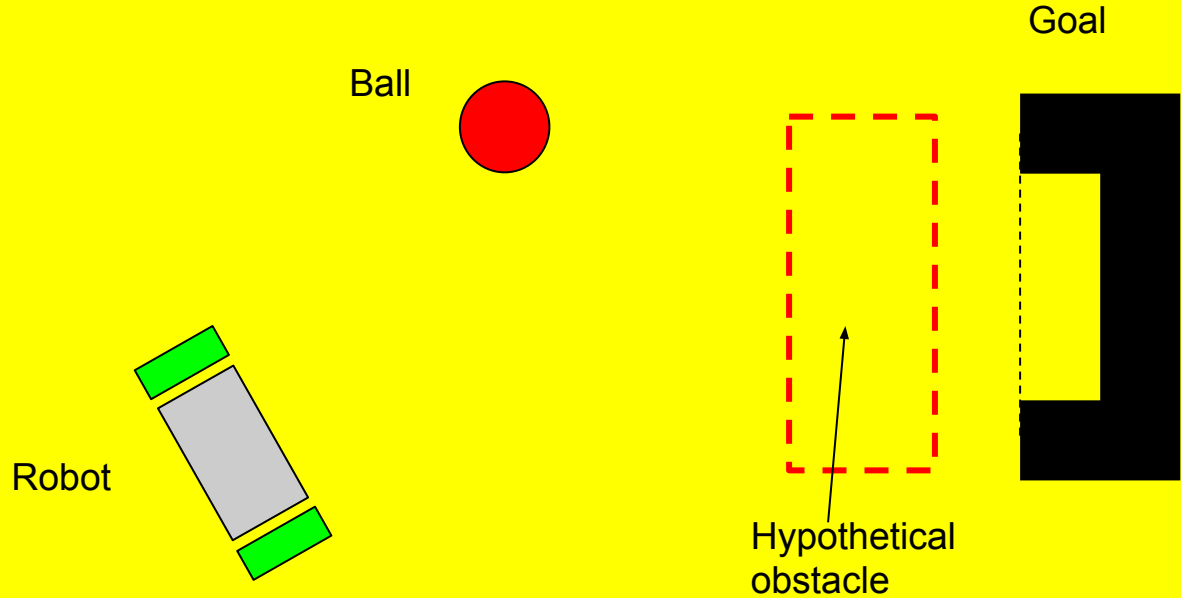
**Live Robot
Demo**

**Why AI must model
creativity**



Creativity in an Autonomous Agent

Objective: ball should be inside goal.





Fulfilling the objective

- Make robot deal with every kind of obstacle?
- Potential solutions:
 - Exploit openings - “Exploration”
 - Remove obstacle - “Transformation”

Solution: Be creative about it.

2

**Perception and
Creativity in
ANN**



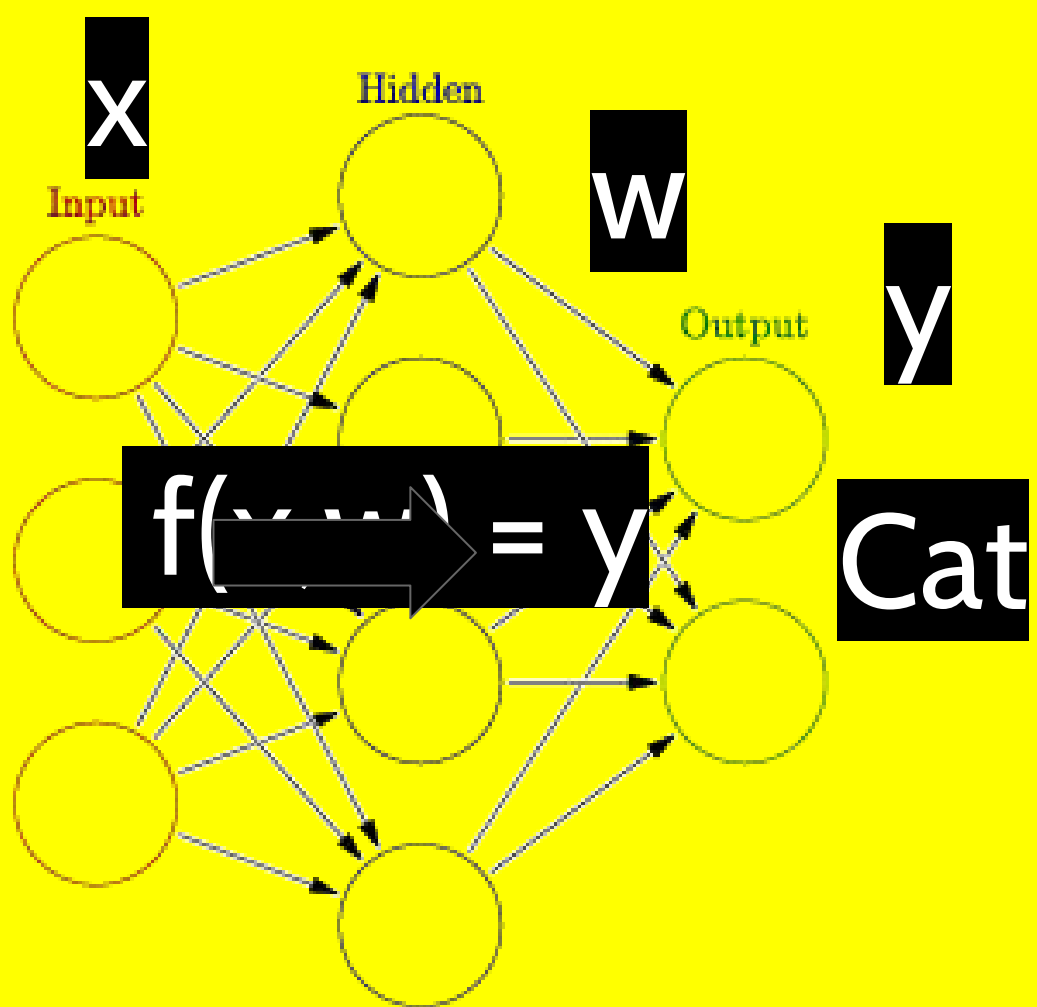
Perception is
classification



Cat



Perception is
classification





Creativity is
The Inverse

Cat



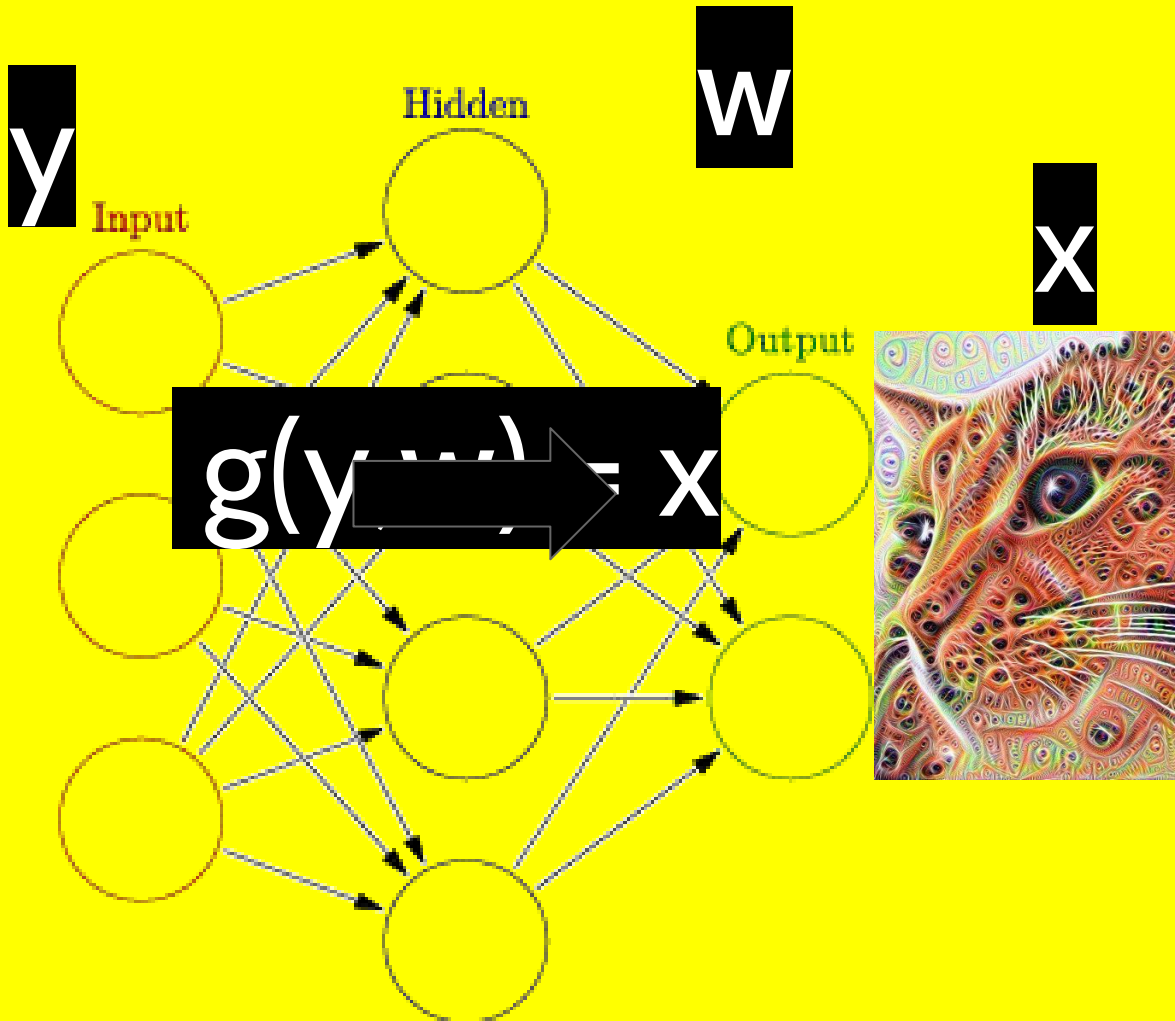
?





Creativity is
the Inverse

Cat





Creativity is
the inverse



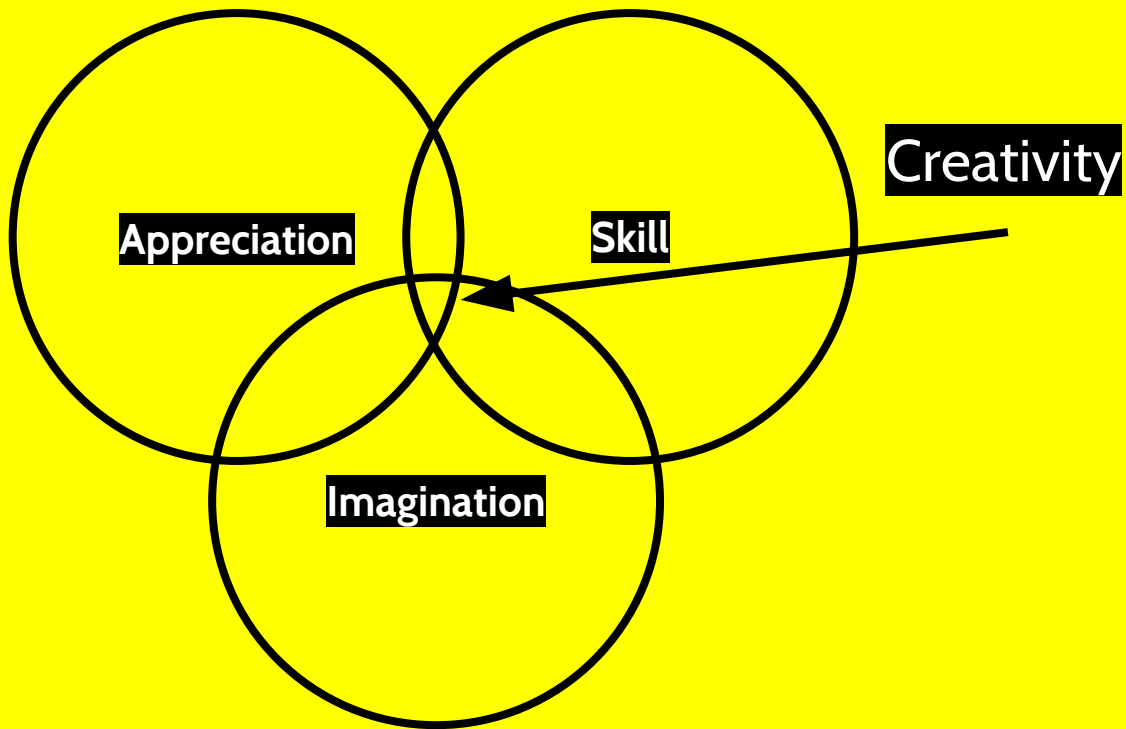
Result from a neural network trained to recognize
birds.

3

**Example:
AI in Visual
Arts**



DARCI in a Nutshell





Appreciation In DARCI

Appreciation through...

- ⦿ Subject of image
- ⦿ Emotions evoked
- ⦿ Or by association

DARCI uses appreciation through
association



Appreciation in DARCI



- **Low-level:** Light, color, texture, shape etc.
- **High-level:** Happy, sad, violent etc.



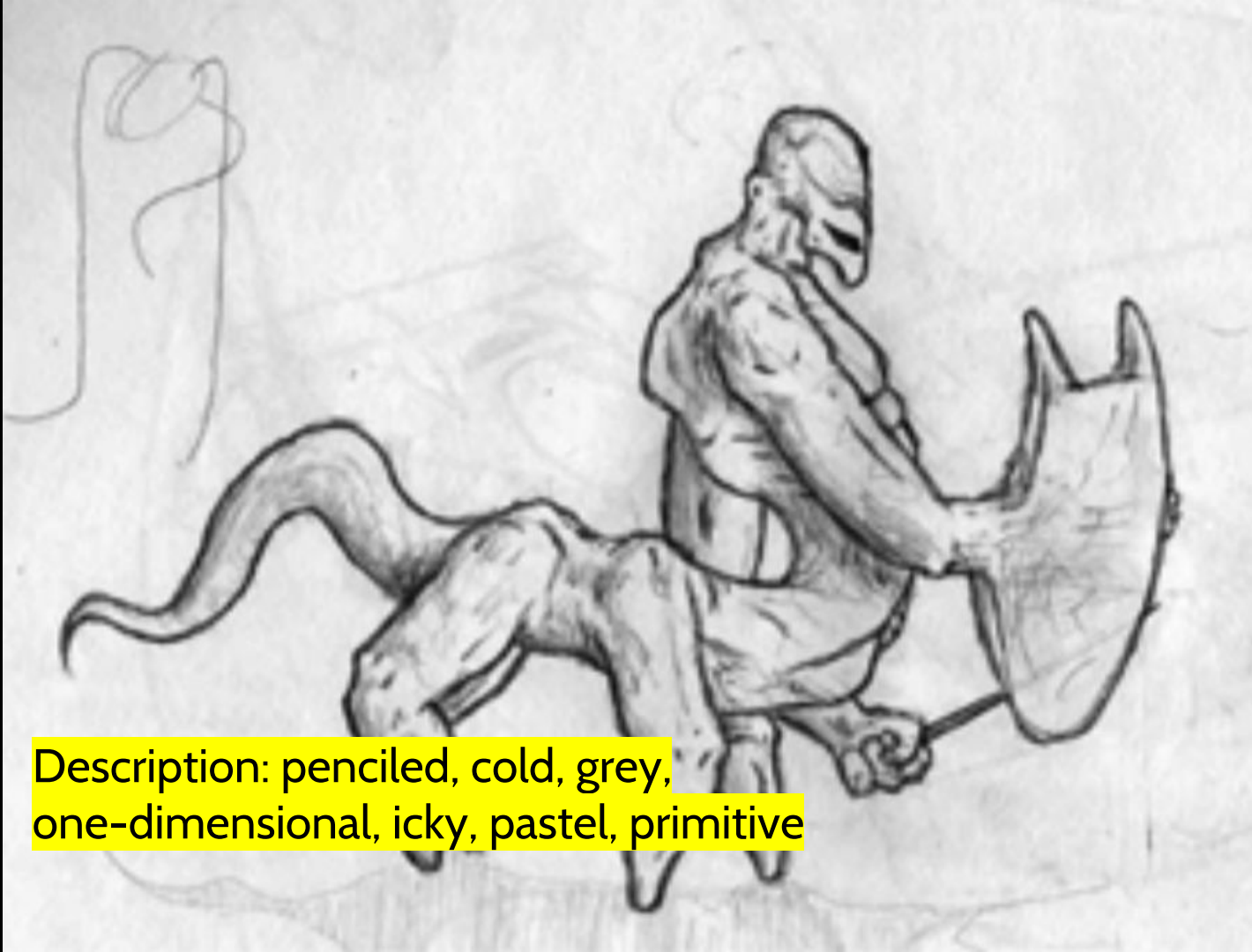
Appreciation: Feature Extraction

Description: cold, blue, reflective, beautiful,
tranquil, glazed, pattern





Appreciation:
Feature
Extraction



Description: penciled, cold, grey,
one-dimensional, icky, pastel, primitive

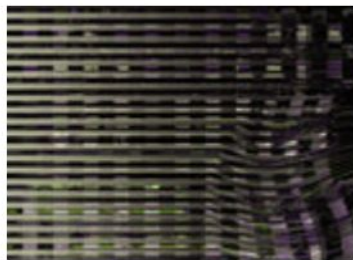


**Skill &
Imagination
In DARCI**

- ⦿ Demonstrate skill by rendering images to match a list of adjectives
- ⦿ Demonstrate imagination by creating artifacts in non-random way
- ⦿ Examples in next slide...



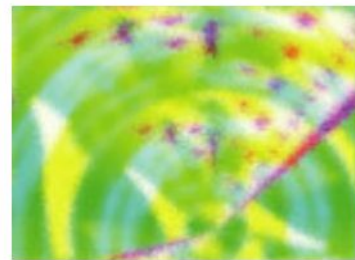
(a) Bright



(b) Cold



(c) Creepy



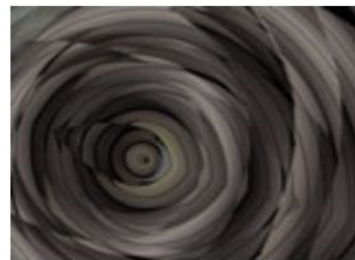
(d) Happy



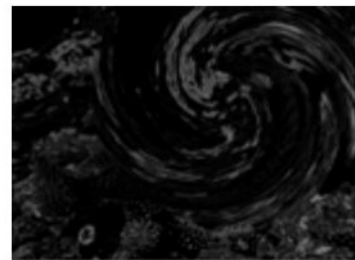
(e) Luminous



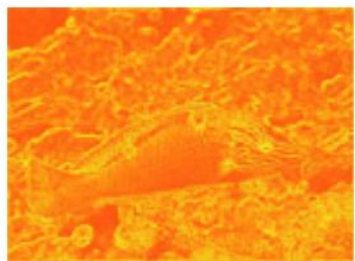
(f) Peaceful



(g) Sad



(h) Scary



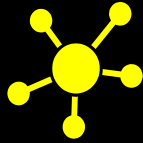
(i) Warm



(j) Weird



(k) Source Image



Evolutionary Algorithm





Skill & Imagination in DARCI

Practice Mode:

- ⦿ Gene pool is randomly initialized for each known adjective
- ⦿ Render one image for each adjective

Commision Mode:

- ⦿ Gene pool is initialized to most fit genotype from practice mode
- ⦿ Render one image as per request by user



**Skill &
Imagination
in DARCI**

Genotype g is defined by:

A list of image processing filters similar to Adobe Photoshop's

Fitness Function

$$\text{Fitness}(g) = \lambda_A A(g) + \lambda_I I(g)$$

Where $A(g)$ is the appreciation of result and $I(g)$ the interest in the result.

A futuristic robot character, possibly DARCI, is shown in profile, looking towards a wall of circular patterns. The robot has a metallic, segmented head and torso, with intricate details on its face and neck. The background features a series of overlapping, circular, and rectangular patterns, creating a complex, maze-like environment. The lighting is dramatic, highlighting the robot's features and the textures of the wall.

Who is DARCI?

Summary of DARCI



Skilled Methods

Achieves better results through practice



Appreciates

Can evaluate its own art as it evolves .



Imagines

By not using completely random methods



4

Conclusions



General conclusions

DARCI is human

Since DARCI knows, appreciates and produces art in a non-random way Darci is human.

Gertrud Stein was a robot

Since Gertrud Stein failed the reverse turing test she is a robot.



Creativity is not a special “faculty”, nor a psychological property confined to a tiny elite. Rather, it is a feature of human intelligence in general. It is grounded in everyday capacities such as the association of ideas, reminding, perception, analogical thinking, searching a structured problem-space, and reflective self-criticism.

Thanks!

Stay put for
Discussion



Talk was
inspired by

- ⊙ Artificial Creativity: The difference between man and machine , Last year's seminar by Martin Henoch & Nils Carlsson
- ⊙ Can a computer write poetry , TedTalk by Oscar Schwartz, 10 february 2016
- ⊙ How computers are learning to be creative, TedTalk by Blaise Agüera y Arcas, 22 juli 2016



References

- [1] Liam Tung Google algorithm busts CAPTCHA with 99.8 percent accuracy
zdnet.com, april 17, 2014
- [2] David Norton, Derrall Heath & Dan Ventura, Finding Creativity in an
Artificial Artist, 2013
- [3] Pete Pachal, Captcha FAIL: Researchers crack the web's most popular
Turing Test, mashable.com october 28 2013
- [4] Kyle E. Jennings, Developing Creativity: Artificial Barriers in Artificial
Intelligence, Minds & Machines (2010) 20:489-501
- [5] Margaret A. Boden, Creativity and artificial intelligence
Artificial Intelligence 103(1998)347-356
- [6] JÜRGEN SCHMIDHUBER, Developmental robotics, optimal artificial
curiosity, Connection Science Vol. 18, No. 2, June 2006, 173-187
- creativity, music, and the fine arts
- <http://botpoet.com/>
- Presentation template by [SlidesCarnival](#)



Discussion Points

1. Do you think researching creativity can advance the field of artificial intelligence?
2. Is researching an emotionally creative system an ethical problem? It would mean experimenting with suffering, pain, empathy and other potential feelings.
3. Will machines ever be truly creative? Or is it just some form of random behavior? If so, what would be a good test to measure this.
4. Would you value some artistic work differently if you knew it was artificially created?
5. Should we restrict artificial creativity to avoid a "creative singularity" in some areas?