

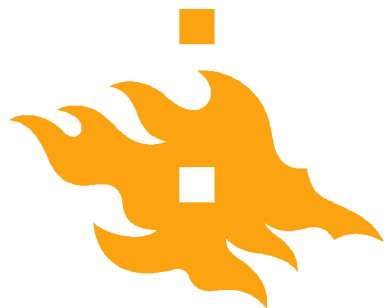


A short introduction to Computational Creativity

Hannu Toivonen

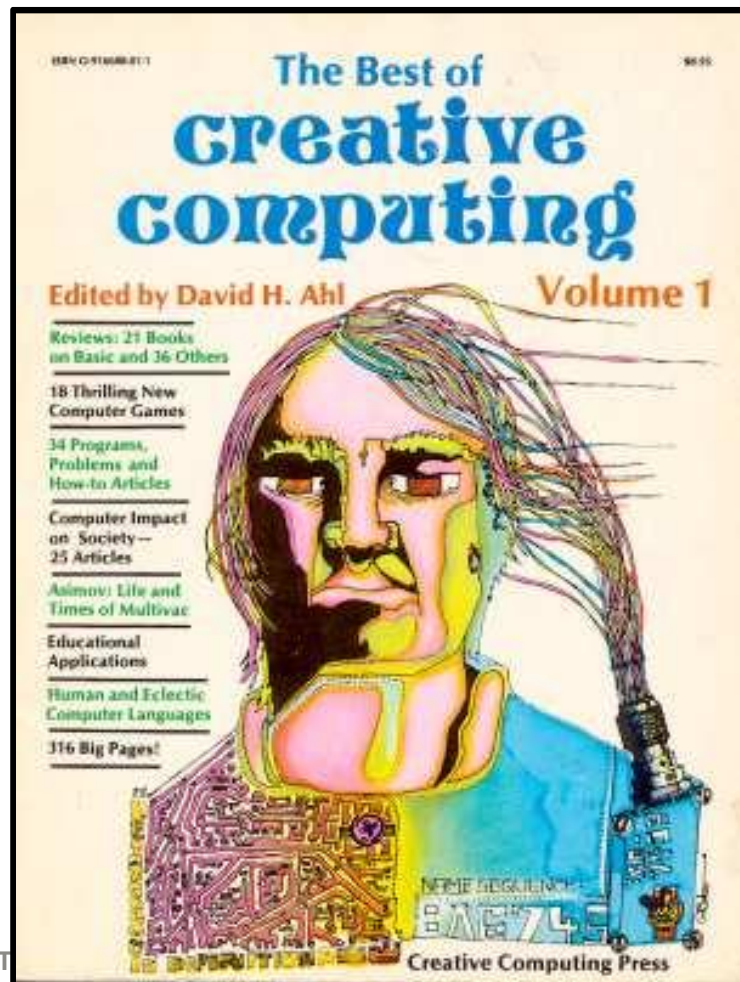
University of Helsinki

www.cs.helsinki.fi/hannu.toivonen





Computational creativity



- Creative computers, machine creativity
- Computers supporting human creativity
- Studies of creative computational processes



– Turing et al, 1950s: generation of music





From Ping Xiao and Simo Linkola: Vismantic: Meaning-making with Images, ICCV 2015



-
- What do you call a murderer with fibre?
 - A cereal killer.

By JAPE (Greame Ritchie and others)



Course overview

The course is an introduction to

- Concepts and theories of computational creativity
 - different types of creativity, formalization of creativity as search, social creativity, ...
- Computational creativity in some fields
 - language, music, images, ...
- Philosophy of computational creativity
 - what is creativity, what is creative autonomy, how to assess creativity, ...



What is (computational) creativity?



Defining creativity

- Many definitions. A representative one:

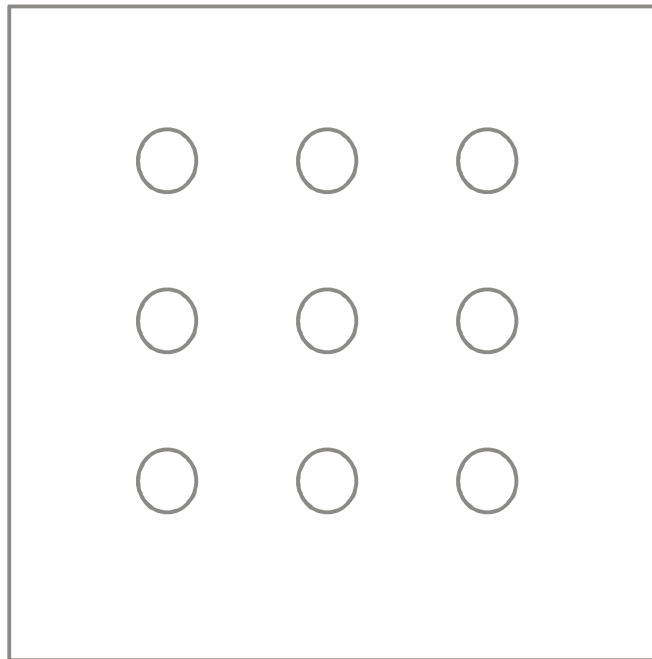
“Creativity is the ability to come up with ideas or artefacts that are new, surprising, and valuable.”

- Boden 1992

- Note: Human creativity is typically defined by the output
- Tests like Torrance (below) are used in practical settings



-
- Connect the nine dots with four straight lines, without lifting the pen





Measuring creativity in humans

E.g., Torrance test of creative thinking:

- *Fluency*: ability to produce of *many* ideas
- *Flexibility*: ability to produce *different* ideas
- *Originality*: ability to produce *unusual* ideas
- *Elaboration*: ability to *explain* ideas

Note: in this course, “idea” ≈ “artefact” ≈ “concept”
= the product of creation



Three types of creativity (Boden 1992)

1. *Combinational*: new combinations of familiar ideas
2. *Exploratory*: generation of new ideas by exploration of a space of concepts
3. *Transformational*: involves a transformation of the search space so new kinds of ideas can be generated.



An alternative typology

- We propose the following, extended classification of different types of creativity (Xiao, Toivonen et al 2015)
- The types differ in terms of the input they take
- Additionally, there is the transformational case



What is computational creativity?

Computational creativity is

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

- Colton and Wiggins 2012



Computational creativity – why on earth?

- An ultimate AI challenge
- A test bed for AI methods
- Applications
 - Games
 - User interfaces, usability
 - Applications where human creativity is not feasible, e.g., instant creativity
 - Support of human creativity
- An intellectual challenge



sleepmusicalization.net


Sleep musicalization

Composed songs

Sleep musicalization

Perceive your sleep as a unique musical experience!

Musicalization turns data into a genuine piece of composed music.

 Try it on your Beddit data!

Introduction

Sleep musicalization is a novel way of perceiving and experiencing sleep measurement data. The goal is to help users understand and analyze their sleeping patterns and eventually improve their sleep.

The musicalization process follows musicological principles when composing a melody, designing the rhythm and changes in tempo, arranging the accompaniment, and playing out the music at different levels of volume. These aspects are inspired but not dictated by the data. The result of musicalization of eight hours of sleep is an original piece of couple of minutes of music.

Musicalization of data provides a whole new way to experience data as a music. Music has a unique capability to invoke emotions, giving users a novel opportunity to perceive their data

Listen to latest samples

Sleeper Agent

Contributed by UFOPOLI

 Listen

Wild Trances

Contributed by UFOPOLI

 Listen

Deep dreams

Contributed by discovery

 Listen

Hannun viime yö

Contributed by discovery

 Listen

eva 09/11/12

 Listen



Listening to sleep music

Sleep musicalization

Composed songs

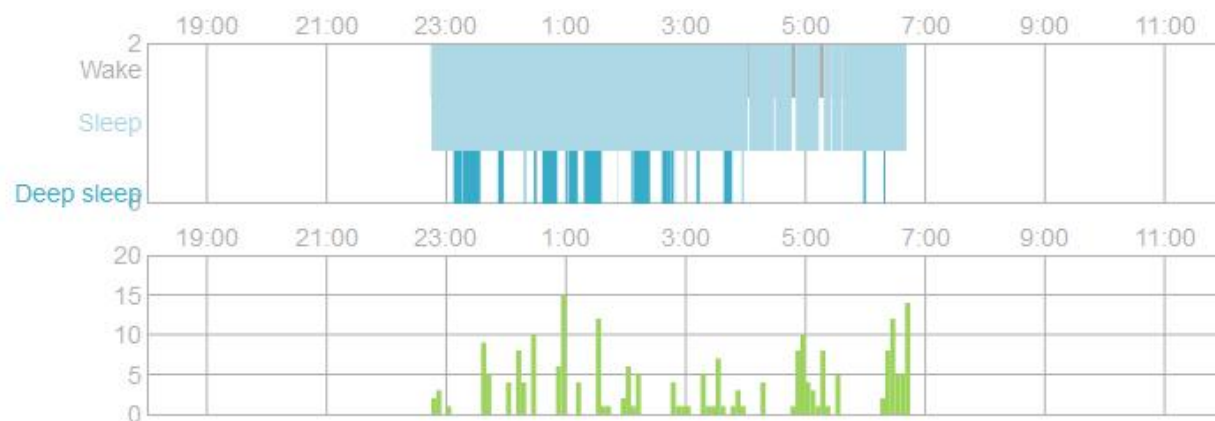


Deep dreams

Share this song

Copy-paste the following link to email, discussion, etc:

<http://sleepmusicalization.net/song/wOqbl1icfDNE>



Sleep stages visualized

The hypnogram on the left shows visualized sleep stages.

Movements during the sleep

The actigram on the left shows the amount of movements during the night.

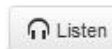
My songs

There are no songs yet

Latest songs

Sleeper Agent

Contributed by UFOPOLI



Wild Trances

Contributed by UFOPOLI





Data mining (DM) and Artificial Intelligence (AI) vs. Computational Creativity



Data Mining vs. Computational Creativity

“Creativity is the ability to come up with ideas or artefacts that are new, surprising, and valuable.”

- Boden 1992

“KDD is the nontrivial process of identifying valid, novel, potentially useful, and ultimately understandable patterns in data.”

- Fayyad et al. 1995

So is computational creativity \approx data mining?



Data Mining vs. Computational Creativity

Data Mining problems	Computational Creativity problems
<i>Well-specified</i> (e.g., "induce a classifier", "find all frequent patterns")	<i>Ill-defined, open-ended</i> (e.g. "write a poem")
<i>Have obvious and objective success criteria</i> (e.g. classification accuracy)	<i>Have subjective and non-explicit criteria</i> (e.g. when is a poem good?)
<i>Success can be measured with relative ease</i> (e.g. evaluate on test set)	<i>Evaluation cannot be computed easily</i> (e.g. ask subjects to evaluate)



Learning objectives



After taking the course, students are able to...

- Describe and analyse creative systems using concepts and theories of computational creativity
 - Creativity as search; the FACE model
- Implement generic generative methods
 - Markov models, genetic algorithms
- Produce creative software for various fields
 - language, music, images