Can a computer make us laugh?

INFO-H-512 - Current trends in AI

Jacopo De Stefani

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Introduction
Computational Creativity
Computational Humor

Computational Humor

Humor

The tendency of particular cognitive experiences to provoke laughter and provide amusement.

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In science, cognition is a group of mental processes that includes attention, memory, producing and understanding language, learning, reasoning, problem solving, and decision making. Cognition is a faculty for the processing of information, applying knowledge, and changing preferences. Cognition, or cognitive processes, can be natural or artificial, conscious or unconscious.

Computational
~ The possibility of being modeled on a computer.
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Why computational humor?

- On the human side humor:
  - Affects attention and memory.
  - Facilitates social interactions.
- Under a research point of view, humor modeling:
  - Is an *AI-complete* problem.
  - Could give insights into how humans process real, complex, creative language.

Source: [BNS+06],[SS03]

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- (Cognitive) Humor also has a positive effect on the mental state of those using it and has the ability to improve their activity.
- (Computational) A successfully humorous computational system must:
  - Recognize situations appropriate for humor
  - Choose a suitable kind of humor for the situation
  - Generate humorous output
  - Evaluate the feedback (if any)
- (Computational) AI-Complete: As difficult as any other AI problem.

Which are the fields concerned?

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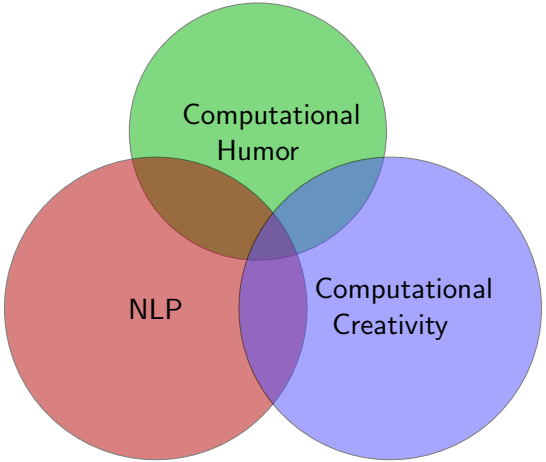

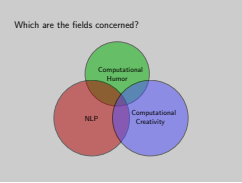

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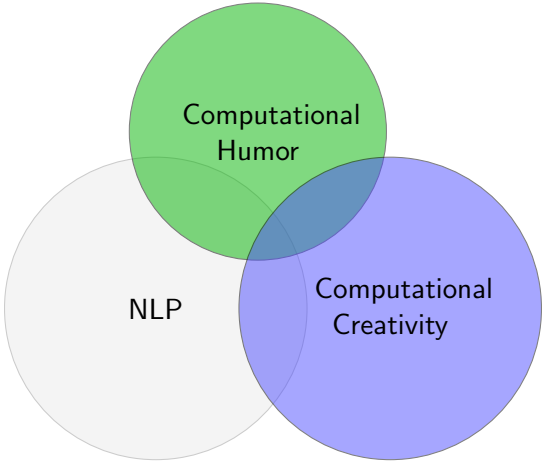

Which are the fields concerned?
Computational Humor
NLP
Computational Creativity

What is computational creativity?

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Computational creativity is the study and simulation, by computational means, of the behaviour, natural and artificial, which would, if observed in humans, be deemed creative.

from *The Association of Computational Creativity*

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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

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How is creativity defined?

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Definition

"Creativity can be defined as the ability to generate novel and valuable ideas."

Source: [Bod09],[Bod98]

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"Creativity can be defined as the ability to generate **novel** *and valuable ideas."*

Novelty

- Psychological - P-Creativity
- Historical - H-Creativity

Source: [Bod09],[Bod98]

- Mainly two types of creativity:
  - **P-Creativity:** (Psychological or Personal) Novelty with respect to who made the invention.
  - **H-Creativity:** (Historical) P-creative and never occurred in history before.
- Computer models aim at P-Creativity

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Definition

"Creativity can be defined as the ability to generate novel and **valuable** *ideas."*

Valuation

- Difficult to model
- Based on cultural and socially accepted style of thoughts.
- Subjective and dependant on motivation and emotional factors

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- Valuable, here, has many meanings: interesting, useful, beautiful, simple, richly complex, and so on.
- Ideas is an umbrella term for (concepts,theories, interpretations, stories), but also artifacts such as graphic images, sculptures, houses, and jet engines).
- The structures generated within newly transformed spaces will need types of evaluation different (at least in part) from those implicit within the original space, or previously provided in explicit form.

How can creativity be achieved?

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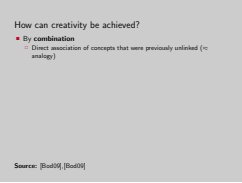
How can creativity be achieved?

- By **combination**
  - Direct association of concepts that were previously unlinked (≈ analogy)

Source: [Bod09],[Bod09]



- **Combination**
  - Generally the most studied problem.
  - Given a set of concepts, it is easy for a computer to combine them, but it is difficult to obtain valuable combination.
  - AI Models of analogy: Domain-general mapping rules, applied to prestructured co concepts, generally based on a preexisting inter-linked knowledge base (or semantic networks)

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Source: [Bod09],[Bod09]

- **Exploration**
  - Exploration rules must be computable.
  - Exploration rules are determined by AI skills along with expertise in the domain.
  - Exploration assume the existence of a general theoretical framework.

How can creativity be achieved?

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  - of a conceptual space (style of thinking)
  - defined by a set of generative rules
- By **transformation**
  - of the conceptual space
  - by altering or dropping one of more of its defining dimensions (rules)

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- **Transformation**
  - ∼ Exploration at a meta-level.
  - May involve self-modification of the creative agent.
  - Generally difficult to automate.
- All the definitions tries to map the creative process to some interaction with a search space.
- Two major bottlenecks:
  - **Domain-expertise:** Required for mapping the conceptual space that is to be explored and/or transformed.
  - **Results valuation:** Necessary and especially difficult for transformational programs.

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A formal framework for the analysis of creative systems have been presented in [Wig06].

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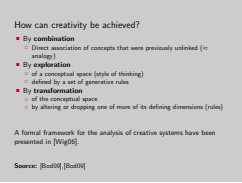

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Successful examples

- **Combinational creativity**
  - JAPE : A program for producing punning riddles [Bin96]
- **Exploratory creativity**
  - EMI : Experiments in musical intelligence [Cop91]
  - Jazz improvisation in the style of Charlie Parker [Hod05]
  - AARON : Line drawing and coloring painter [Coh95]
  - BACON : Heuristic-based suite to model scientific discovery [Sta88]
- **Transformational creativity**
  - Automated Mathematician [Len83]
  - Eurisko [Len83]

- **Combinational creativity**
  - Joke forms: What do you get when you cross X with Y?; Whats the difference between an X and a Y? The semantic network used by the program incorporates knowledge of phonology,semantics, syntax, and spelling.
- **Exploratory creativity**
  - EMI : Program that composes in the styles of Mozart, Stravinsky, Joplin, and others.In order to do this, it employs powerful musical grammars expressed as ATNs.
  - Besides strong (and relatively general) knowledge of musical dimensions such as harmony and rhythm, and of musical conventions characteristic of jazz, the system has access to a large set of Parker-specific motifs, which can be varied and combined in a number of ways.
  - AARON cannot reflect on its own productions,nor adjust them so as to make them better. It cannot even transform its conceptual space. In this, it resembles most current AI-programs focused on creativity.

Why CH is AI-Complete?

A successfully humorous computational system should be able to:

1. Recognize situations appropriate for humor.
2. Choose a suitable kind of humor for the situation.
3. Generate an appropriately humorous output.
4. (In case of interaction or control) Evaluate the feedback.

Source: [SS03]

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Which AI fields are concerned?

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- **Humor generation**
  - Choose a suitable kind of humor for the situation.
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- **Humor detection**
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- **Humor generation $\longmapsto$ Computer Creativity**
  - Choose a suitable kind of humor for the situation.
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- **Humor detection $\longmapsto$ NLP**
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