Computational Creativity at the Next Level

Towards the What-If Machine

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Oh no! It’s a ...

... Live Demonstration

Mood based portraiture - You Can’t Know my Mind
Computational Creativity...

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

Also note the deliberate lack of mention of value of generated artefacts (poems, paintings, theorems, etc.) and the lack of mention of comparison with people
A Definition of...  Creativity
Two views of Computational Creativity

A Hard Science?

• “Hard” (Computational) science about “Soft” (non-scientific) subjects such as the arts, literature, music

• As opposed to hard science about hard science (or even financial) data, which we saw this morning

• Better seen as an engineering subject

• Where we use two main evaluation methods:
  • The scientific method (falsifiable hypotheses, etc.)
  • Artistic methods (gallery exhibitions, concerts, etc.)
Human Level Creativity

There are four main reasons to study human creativity with Computational Creativity research:

- Because the artefacts produced are for human consumption (product)
- It’s ultimately human recognition of our software being creative that we seek (process)
- People take computationally created artefacts and are creative with them (interpretation, etc)
- We can program software to be more creative by understanding well human creative processes
I need a volunteer...

Perhaps someone with a birthday coming up soon?
• Aim: to build a system which is - one day - taken seriously as a creative artist in its own right.
• Around 10 years of work
• Involves graphics (NPR), AI and vision: painting is very much a cognitive process
• Following the creativity “tripod”:
  • Skill, appreciation, imagination
  • Intentionality, accountability

“Simulating artistic techniques means also simulating human thinking and reasoning, especially creative thinking. This is impossible to do using algorithms or information processing systems”

Strothotte and Schlechtweg
Non-Photorealistic Computer Graphics
Morgan Kaufmann, 2002
Timeline
Ten Years of Development
Timeline

Ten Years of Development
Timeline
Ten Years of Development
Timeline
Ten Years of Development
Timeline
Ten Years of Development
Timeline
Ten Years of Development
12-19th July 2013

You Can’t Know My Mind

A celebration of computational creativity
art poetry cuisine music

Galerie Oberkampf
103 rue Saint Maur Paris 11

www.thepaintingtool.com
I read the article: "Can Rio+20 bring change for women?" in the global-development section.
2012-06-19_global-development_rio20-bring-change-women
This was chosen by time of day: 13:52:55
My mood valency is 0.0 (reflexive).

I read the article: "Iran nuclear scientist killed in Tehran motorbike bomb attack" in the world section.
2012-01-11_worldiran-nuclear-scientist-killed
This was chosen by cross reference with the keyphrase "nuclear whistleblower mordechai vanunu".
My mood valency is -0.012362384 (reflexive).

I read the article: "This covert war on Iran is illegal and dangerous" in the commentisfree section.
2012-01-11_commentisfree_covert-war-iran-illegal-dangerous
This was chosen by cross reference with the keyphrase "nuclear whistleblower mordechai vanunu".
My mood valency is -0.017533412 (negative).

I read the article: "Iranian nuclear scientist killed in Tehran bomb explosion" in the world section.
2012-01-11_world_bomb-kills-iranian-nuclear-scientist
This was chosen by cross reference with the keyphrase "nayanz uranium enrichment plant".
My mood valency is -0.023763323 (negative).

I read the article: "A better understanding of Iran might save us from catastrophe" in the commentisfree section.
2012-03-11_commentisfree_peter-beaumnont-iran-nuclear-threat
This was chosen by cross reference with the keyphrase "nuclear weapons technology".
My mood valency is -0.03188835 (very negative).

I read the article: "Iran's supreme leader denies Tehran is seeking nuclear weapons" in the world section.
2012-02-22_world_iran-supreme-leader-nuclear-weapons-denial
This was chosen by cross reference with the keyphrase "nuclear fuel cycle".
My mood valency is -0.03489885 (very negative).
I read the article: "St Paul’s eviction: ‘It could have been a lot nastier’” in the uk section.
2012-02-28_uk_st-pauls-eviction-occupy-london
This was chosen by cross reference with the keyphrase "london stock exchange movement".
My mood valency is 0.0 (reflexive).
I read the article: "It’s time to talk to the City" in the politics section.
2012-02-20_politics_free_financial-sector-reform-dialogue
This was chosen by cross reference with the keyphrase "london stock exchange movement".
My mood valency is 0.0 (reflexive).
I read the article: "St Paul’s eviction: ‘It could have been a lot nastier’” in the uk section.
2012-02-28_uk_st-pauls-eviction-occupy-london
This was chosen by cross reference with the keyphrase "london stock exchange movement".
My mood valency is 0.0 (reflexive).
I read the article: "London’s homeless could be forced to move as far as Hull" in the society section.
2012-02-18_society_london-homeless-forced-move-hull
This was chosen by cross reference with the keyphrase "environmental health officers".
My mood valency is 0.0 (reflexive).
I read the article: "London Tory councils consider moving claimants to Midlands" in the society section.
2012-04-24_society_tory-westminster-council-tenants-derby
This was chosen by cross reference with the keyphrase "several other yorkshire towns".
My mood valency is 0.0 (reflexive).
I read the article: "London council seeks to move benefit claimants from capital" in the society section.
2012-04-24_society_london-borough-benefits-claimants-outside-capital
This was chosen by cross reference with the keyphrase "brighter futures housing association".
My mood valency is 0.0 (reflexive).
I read the article: "London looks to export council tenants" in the society section.
2012-04-24_society_london-exporting-council-tenants
<table>
<thead>
<tr>
<th>Mood</th>
<th>Upper</th>
<th>Downer</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>215 (0.015, 0.042)</td>
<td>193 (-0.01, -0.04)</td>
</tr>
</tbody>
</table>

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**Description**

- **October 2012**:
  - I read the article: "Liverpool agree £1m deal to sign Sporting Lisbon teenager João Ferreira" in the football section.
  - 2012-10-02, football_liverpool-sporting-lisbon-joao-carlos
  - This was chosen by cross reference with the keyphrase "luis figo".
  - My mood valency is 0.011616783 (very positive).

- **November 2012**:
  - I read the article: "West Ham move to sign Ravel Morrison from Manchester United" in the football section.
  - 2012-11-30, football_west-ham-ravel-morrison-manchester-united
  - This was chosen by cross reference with the keyphrase "talented young players".
  - My mood valency is 0.010259833 (very positive).

- **December 2012**:
  - I read the article: "New Year’s honours: Today’s knighthoods speak volumes about our society" in the commentbisection.
  - 2012-12-01, commentbisection_observer-editorial-new-years-honours
  - This was chosen by cross reference with the keyphrase "vital part".
  - My mood valency is 0.0076275514 (positive).

- **January 2013**:
  - I read the article: "Is the ‘rare sense celebrities say’ report good for science?” in the commentbisection.
  - 2013-01-02, commentbisection_sense-about-science-report-celebrities
  - This was chosen by cross reference with the keyphrase "reality tv star".
  - My mood valency is 0.0069458866 (positive).

- **February 2013**:
  - I read the article: "Syria crisis: Damascus clashes continue - Tuesday 17 July 2012" in the world section.
  - 2013-02-17, world_syria-crisis-damascus-clashes-live
  - This was chosen by cross reference with the keyphrase "free last week".
  - My mood valency is 0.006963716 (positive).

- **March 2013**:
  - I read the article: "Governments around the world expel Syrian diplomats – Tuesday 29 May" in the world section.
  - 2013-03-29, world_syria-bashar-al-assad
  - This was chosen by cross reference with the keyphrase "government news agency reports".
  - My mood valency is 0.0054293834 (positive).

- **April 2013**:
  - I read the article: "Egypt: Mubarak ‘improves’ as crisis worsens - Wednesday 20 June 2012" in the world section.
  - 2013-04-20, world_egypt-crisis-mubarak-coma-live
I read the article: "Unilever row over pensions, profits and executive pay at Port Sunlight" in the business section.
2012-01-18_business_row-pensions-profits-unilever
This was chosen by cross reference with the keyphrase "ceo paul polman".
My mood valency is 0.0074096834 (experimental).

I read the article: "NFL referees dispute is about assault on workers' rights not blown calls" in the sport section.
2012-09-26_sport_nfl-referee-workers-rights-packers-seahawks
This was chosen by cross reference with the keyphrase "future retirement income".
My mood valency is 0.0050184834 (experimental).

I read the article: "Facebook IPO: commentary and analysis from around the web" in the commentifree section.
2012-05-16_commentifree_facebook-ip-o-commentary-analysis-web
This was chosen by cross reference with the keyphrase "total revenue last year".
My mood valency is 0.0020820484 (experimental).

I read the article: "NFL referees dispute is about assault on workers' rights not blown calls" in the sport section.
2012-09-26_sport_nfl-referee-workers-rights-packers-seahawks
This was chosen by cross reference with the keyphrase "total revenue last year".
My mood valency is 0.0016462291 (experimental).

I read the article: "NHL: five things we learned this week" in the sport section.
2012-01-04_sport_winter-classic-lya-bryzgalov-jaromir-jagr
This was chosen by cross reference with the keyphrase "refs".
My mood valency is 0.0018635072 (experimental).

I read the article: "Diary" in the politics section.
2012-01-02_politics_hugh-muir-diary-hoxha
This was chosen by cross reference with the keyphrase "flyers".
My mood valency is 0.0031759996 (experimental).

I read the article: "Indian campaign confronts prevalence of female foeticide" in the world section.
2012-07-13_world_india-campaign-debate-female-foeticide
I read the article: "SuperGroup soars after festive sales, while sweet mince pies boost Greggs" in the business section.
2012-01-11_business_supergroup-soars-greggs-sainsbury
This was chosen by cross reference with the keyphrase "chief executive julian dunkerton".
My mood valency is 0.019694632 (positive).

I read the article: "BP and BG lead FTSE higher as new year rally continues" in the business section.
2012-01-04_business_bp-bg-boasted-by-oil-price
This was chosen by cross reference with the keyphrase "third quarter sales".
My mood valency is 0.02237465 (positive).

I read the article: "FTSE falter on renewed eurozone fears but Amec buoyed by buy notes" in the business section.
2012-01-04_business_ftse-eurozone-fears-amec-buy-notes
This was chosen by cross reference with the keyphrase "online fashion specialist asos".
My mood valency is 0.023648428 (positive).

I read the article: "BP and BG lead FTSE higher as new year rally continues" in the business section.
2012-01-04_business_bp-bg-boasted-by-oil-price
This was chosen by cross reference with the keyphrase "online fashion specialist asos".
My mood valency is 0.021897728 (positive).

I read the article: "Bleak midwinter for high street's losers" in the business section.
2012-01-02_business_retail-christmas-losers-winners
This was chosen by cross reference with the keyphrase "asos".
My mood valency is 0.0227309 (positive).

I read the article: "HMV Christmas sales tumble" in the business section.
2012-01-09_business_hmv-christmas-sales-tumble
This was chosen by cross reference with the keyphrase "argos owner home retail".
My mood valency is 0.017907375 (positive).
I read the article: "Johnny Dawes: 'It's about doing something that's fun... and impossible' in the sport section.
2012-01-01_sport_johnny-dawes-interview-rock-climbing
This was chosen by cross reference with the keyphrase "screenplays".
My mood valency is 0.031990394 (very positive).

I read the article: "Coachella 2012: Radiohead, Dr Dre and Snoop Dogg to headline" in the music section.
2012-01-10_music_coachella-2012-radiohead-dr-dre-snoop-dogg
This was chosen by cross reference with the keyphrase "dawes".
My mood valency is 0.028465983 (positive).

I read the article: "Live music: coming up" in the music section.
2012-03-20_music_live-music-coming-up
This was chosen by cross reference with the keyphrase "first aid kit".
My mood valency is 0.028268874 (positive).

I read the article: "La Clemenza di Tito - review" in the music section.
2012-03-23_music_la-clemenza-di-tito-review
This was chosen by cross reference with the keyphrase "clemenza di tito".
My mood valency is 0.028151035 (positive).

I read the article: "Back to the Future: The Game – review" in the technology section.
2012-05-05_technology_back-to-the-future-game
This was chosen by cross reference with the keyphrase "terrific voice".
My mood valency is 0.028086979 (positive).

I read the article: "Florida primary campaign: the runup to the debate - as it happened" in the world section.
2012-01-23_world_florida-primary-campaign-live
This was chosen by cross reference with the keyphrase "risky business".
My mood valency is 0.03166868 (very positive).
Upper: 1732 (0.015, 0.047)
Downer: 985 (-0.01, -0.05)

I read the article: "Iowa GOP poll shows Romney leading but threatened by Santorum surge" in the world section. 2012-01-01_world_iowa-gop-poll-romney-santorum
This was chosen by cross reference with the keyphrase "rick perry".
My mood valency is -0.031164085 (negative).

I read the article: "Republican candidates ready for first showdown in Iowa caucuses" in the world section. 2012-01-01_world_republican-race-reaches-iowa-caucuses
This was chosen by cross reference with the keyphrase "moines register poll".
My mood valency is -0.032948174 (negative).

I read the article: "Iowa GOP caucus 2012: Romney, Santorum and Paul sprint to the finish" in the world section. 2012-01-02_world_gop-iowa-presidential-caucus-live
This was chosen by cross reference with the keyphrase "iowa straw poll".
My mood valency is -0.03495439 (very negative).

I read the article: "Republicans fear return of the feelgood factor as Iowa caucuses nears" in the world section. 2012-01-01_world_republicans-iowa-feelgood-factor
This was chosen by cross reference with the keyphrase "michele bachechiann".
My mood valency is -0.03506457 (very negative).

I read the article: "Mitt Romney claims narrowest of victories in Iowa caucus" in the world section. 2012-01-04_world_mitt-romney-victory-iowa-caucus
This was chosen by cross reference with the keyphrase "presidential candidate mitt romney".
My mood valency is -0.029252226 (negative).

I read the article: "Politics Weekly podcast: Romney's narrow win in Iowa" in the politics section. 2012-01-04_politics_politics-podcast-romney-iowa
This was chosen by cross reference with the keyphrase "christian fundamentalist rick santorum".
My mood valency is -0.023969386 (negative).
Hello there! Thanks for being my model.
Firstly, please step completely away from the camera, count to three and come back.
Now, please look at the green light above, and give me a big smile. Hold that pose!
I was in a positive mood.
So I wanted to paint a bright portrait.
I aimed to achieve something like this:

And this is my painting:

I think this was a miserable failure.
This is Cutting Edge...

- The You Can’t Know my Mind exhibit has:
  - Skill: realtime portrait painting
  - Appreciation: neural network adjective assessment
  - Imagination: background + image filtering
  - Intentionality: wants painting to match conception
  - Accountability: describes its motivations and processes
  - Introspection: it will try to achieve the adjective better next time
  - An ability to surprise: mood is non-randomly unpredictable
  - Creative acts: (F)raming, (A)esthetics, (C)oncepts, (E)xamples
  - And its a fully functional public-facing demonstration
But...

There is One Thing Missing

• It’s difficult to say that the software came up with a new *idea*

• A process: e.g., “Let’s write something on top of the picture”, “Let’s use a kaleidoscope construction”

• Content: e.g., “Let’s draw the person emerging from the top of the Empire State building”

• New projects in our group:
  • Flaminia Cavallo: ML based ideation, PhD
  • Michael Cook: Creative code generation for entertainment, PostDoc
  • John Charnley: Flowchart invention for process generation, PostDoc
  • EU project: The What-If Machine for automated ideation
WHIM
The What-If Machine

FP7-611560

Simon Colton, Stephen Clark, Pablo Gervás, Nada Lavrac, Tony Veale
WHAT IF BIRDS AREN’T SINGING?

WHAT IF THEY’RE SCREAMING BECAUSE THEY’RE AFRAID OF HEIGHTS?
The Big Picture

• Fictional ideation is an important creative act undertaken regularly by people

• Sometimes for the purpose of uncovering truths

• Other times as a personal expression within the production of a cultural artefact

• Fictional ideas are at the heart of stories, plays, poems, paintings, advertisements, films, TV plots, etc.

• Extremely important in the creative industries

• Computers cannot yet produce such fictional ideas, and we’d like to change that with the WHIM project
To build a What-If Machine...

Research Questions

R1. How can we construct knowledge bases on demand that will contain enough information to support ideation?

R2. What methods can we implement which will reliably produce coherent, salient and potentially interesting fictional ideas?

R3. How can software reliably estimate the potential value of a fictional idea in a particular context?

R4. How can idea presentation methods be reliably chosen, tweaked and utilised to increase audience appreciation?

R5. How can we mine information from feedback about generated ideas and use this to improve the ideation process?
To build a What-If Machine...

Possible Answers

R1. How can we construct knowledge bases on demand that will contain enough information to support ideation?

R2. What methods can we use to identify different, significant and potentially interesting fictional ideas?

R3. How can software reliably estimate the potential value of a fictional idea in a particular context?

R4. How can idea presentation methods be reliably chosen, tweaked and utilized to increase audience appreciation?

R5. How can we mine information from feedback about generated ideas and use this to improve the ideation process?

Novel shallow web-mining approaches to World-View Building, based on open information extraction
To build a What-If Machine...

Possible Answers

R1. How can we construct knowledge bases on demand that will contain enough information to support ideation?

R2. What methods can we implement which will reliably produce coherent, salient and potentially interesting fictional ideas?

R3. How can we most effectively communicate the unique characteristics of a fictional idea in a particular context?

R4. How can idea presentation methods be reliably chosen, tweaked and utilised to increase audience appreciation?

R5. How can we mine information from feedback about generated ideas and use this to improve the ideation process?

Novel ideation methods, via metaphor and humour generation techniques, based on notions of semantic tension and incongruity
To build a What-If Machine...

Possible Answers

R1. How can we construct knowledge bases on demand that will contain enough information to support ideation?

R2. What methods can we implement which will reliably produce coherent, salient and potentially interesting fictional ideas?

R3. How can software reliably estimate the potential value of a fictional idea in a particular context?

R4. How can it be monetized and utilised to increase audience appreciation?

R5. How can we mine information from feedback about generated ideas and use this to improve the ideation process?
To build a What-If Machine...

Possible Answers

R1. How can we construct knowledge bases on demand that will contain enough information to support ideation?

R2. What methods can be used to generate different, salient and potentially interesting fictional ideas?

R3. How can we evaluate the potential of a fictional idea in a particular context?

R4. How can idea presentation methods be reliably chosen, tweaked and utilised to increase audience appreciation?

R5. How can we mine information from feedback about generated ideas and use this to improve the ideation process?

Novel linguistic rendering techniques embedding ideas in poems, stories, neologisms, etc., appealing to affect, obfuscation and relevance
To build a What-If Machine...

Possible Answers

R1. How can we construct knowledge bases on demand that will contain enough information to support ideation?

R2. What methods can we implement which will reliably produce coherent, salient and potentially interesting fictional ideas?

R3. How can we construct an audience model for assessing a fictional idea in a particular context?

R4. How can ideation be specifically supported and utilised to increase audience appreciation?

R5. How can we mine information from feedback about generated ideas and use this to improve the ideation process?

Novel crowd-sourcing and data mining applications for gathering opinions based on well-being and thought provocation, in order to build and utilise an audience model.
Engineering a Solution
• Simon Colton

• Co-ordinator of the project

• Expert on Computational Creativity, esp. artefact generation in mathematics, video game design, visual arts and linguistics

• Will lead WP5 on automated rendering of ideas in linguistic artefacts

• Will also lead WP1, managing project with an administrator at 40% FTE
- Stephen Clark
  - Expert on computational linguistics, esp. text mining
  - Will lead WP2 on World View Building via web mining

- Tony Veale
  - Expert on generative linguistics, esp. metaphor and humour
  - Will lead WP3 on Idea Generation via natural language techniques
  - Dissemination manager
- Pablo Gervás
  - Expert on story generation, including narratology and poem generation
  - Will lead WP4 on Idea Evaluation via narrative generation and evaluation

- Prof. Nada Lavrač
  - Expert on machine learning, esp. data and text mining
  - Will lead WP6 on Audience Modelling from crowd-sourced opinions about ideas
  - Quality manager

[Logos and university names]
Main Objectives

To positively answer the question of whether creative software can move to the next level by generating, assessing and presenting interesting ideas that are really valued by the people who are exposed to them.
Main Objectives

Shallow knowledge extraction techniques are suitable to the building of world views which will support ideation.

Humour, metaphor and category subversions are suitable mechanisms able to take such world views and generate potent ideas from them.

Narratives can be not only be generated to include some reference to a given idea, but can also be used to evaluate the value of those ideas.

Linguistic, idea-centric, rendering methods based on affect, obfuscation and idea expansion can be engineered and automatically chosen intelligently in such a way as to heighten the value that people find in an idea.

Audience models can be effectively learned from crowd sourced opinions about generated ideas using machine learning and data mining techniques and employed to automatically inform the whole idea generation process.

To disseminate our work, changing people’s minds about the creative potential of software.
Methodology

• We will follow a formalism-first methodology

• Defining formally: \textit{f-world}, \textit{f-idea}, \textit{f-narrative}, \textit{f-rendering}, \textit{f-audience} and others before starting implementation

• We will engineer software to manipulate data represented accordingly, and build a consortium-wide repository

• Versions of modules will be tested using both product-based and process-based methodologies

• Weekly progress will be measured against context-dependent modified versions of:

  • Ritchie’s measures for input/output values

  • Colton et. al’s \textit{FACE} model of creative process
Evaluation

• Three major crowd-sourcing exercises will be undertaken, whereby people from the general public are asked questions based on Ritchie’s criteria enhanced with notions from Colton et. al’s IDEA model

• The value of ideas will be measured in terms of the stories imagined, the thoughts provoked and the change in well-being, massaged formally into notions of divisiveness, humour-content, shock, provocation, etc.

• This will pay into our audience appreciation model

• And also provide yardsticks against which we can measure the progress of the What-If Machine

• We will similarly have sessions with creative professionals and also measure impact via public engagement (twitter, facebook, press coverage)
Reasons to Hope...

- Extremely focused and manageable project
- Entire focus is on automating fictional ideation, not other artefacts
- Nearly 20 person years of funding
- Computational Creativity evaluation techniques are highly appropriate here and gaining maturity
- Fictional ideation will really capture the public imagination
- We will have a What-If Machine...
WHAT IF CATS HAVE THEIR OWN INTERNET
AND IT'S FULL OF PICTURES OF US

WHAT IF WE CAN BREATHE IN SPACE
AND THEY JUST DON'T WANT US TO ESCAPE

Thanks for listening