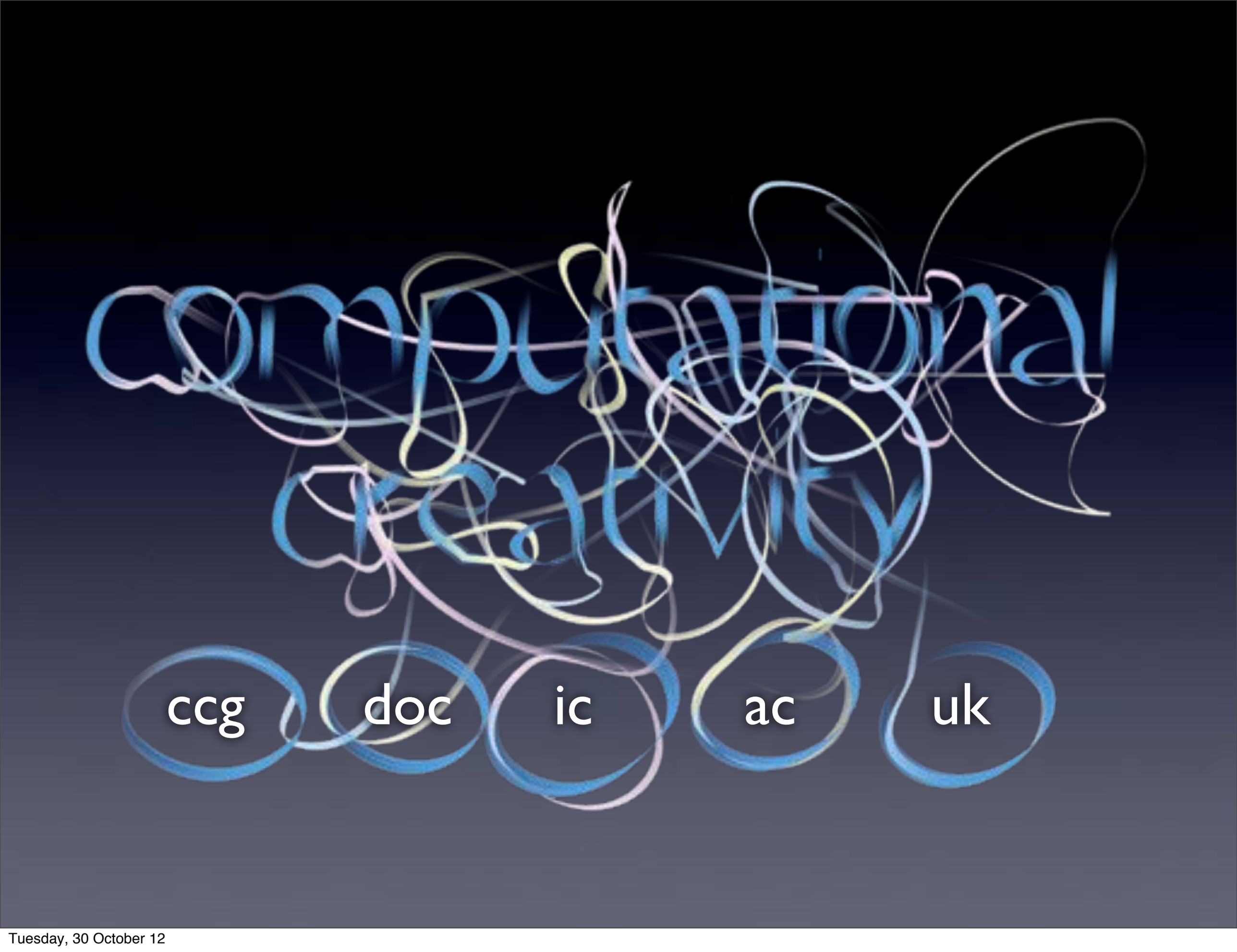
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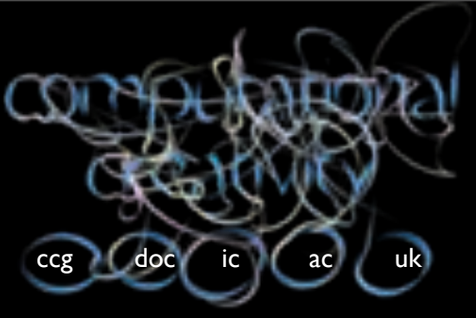
Imperial College London



On Acid-Drops and Teardrops...

The Humanity Gap in Computational Creativity Research

Simon Colton
Computational Creativity Group
Imperial College, London
ccg.doc.ic.ac.uk

On the Menu Today...

- Brief introduction to Computational Creativity
- Setting the scene with The Painting Fool project
- First wave of philosophical contributions
- Future work and new ideas

Computational Creativity...

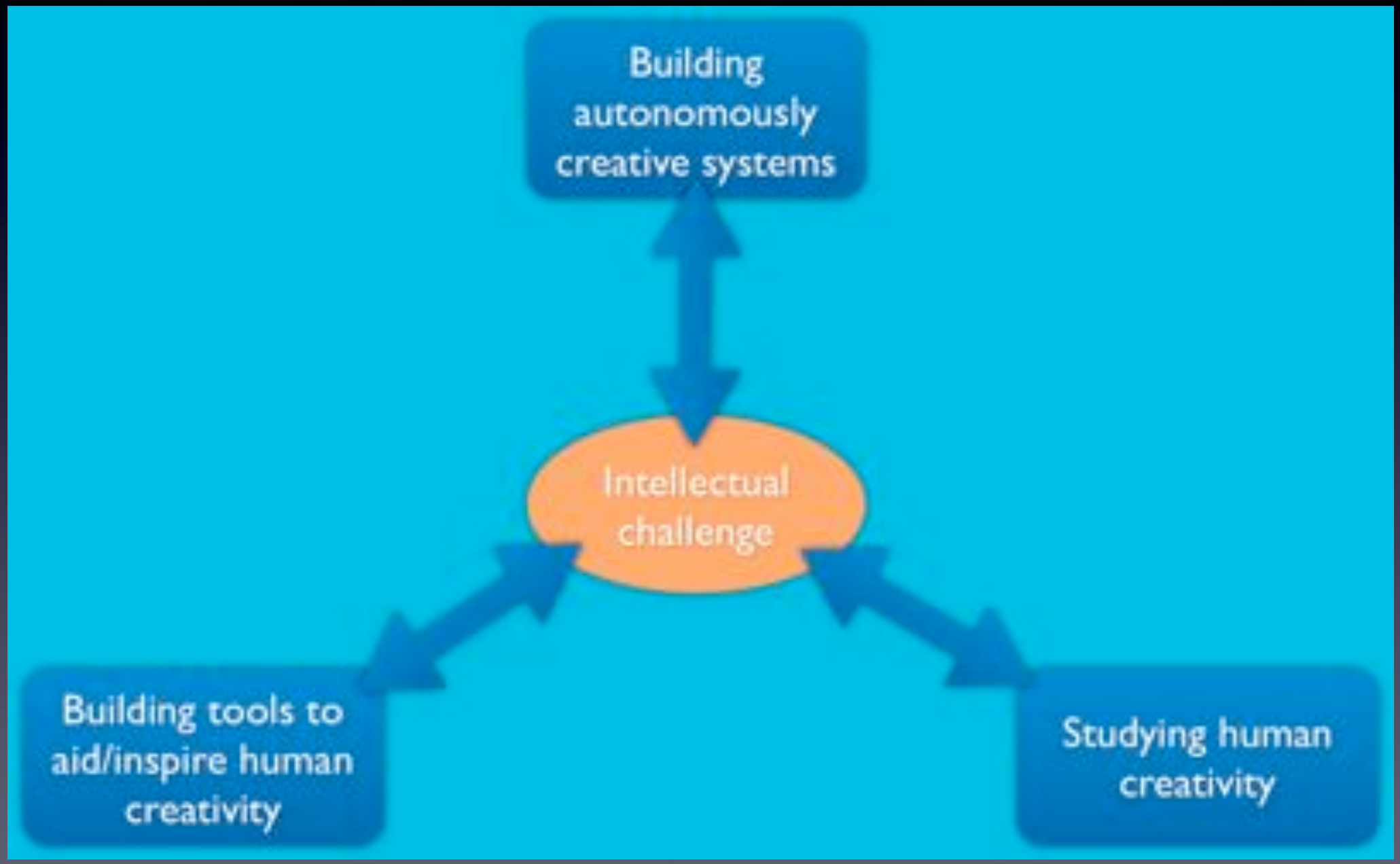
Creative responsibilities

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

Audience participation

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*

Overview


Building autonomously creative systems
Intellectual challenge
Building tools to aid/inspire human creativity
Studying human creativity

Overview

Cognitive sciences, philosophy

AI and other computational sciences

Cultural domains

Music | Art | Design | Maths | Science | Games | Poetry | Stories | Recipes

Cultural Outputs

art exhibitions + prints, scientific publications, concerts, books + anthologies, games, dinner parties

Industrial Involvement

video games companies, art galleries, advertisers (graphics + design firms, music software companies)

Main Issues

- Technological advances
  - *Main challenge:* computational ideation
- Scientific assessment of progress
  - *Main challenge:* moving to process based evaluation
- Sociological changes
  - *Main challenge:* addressing the humanity gap

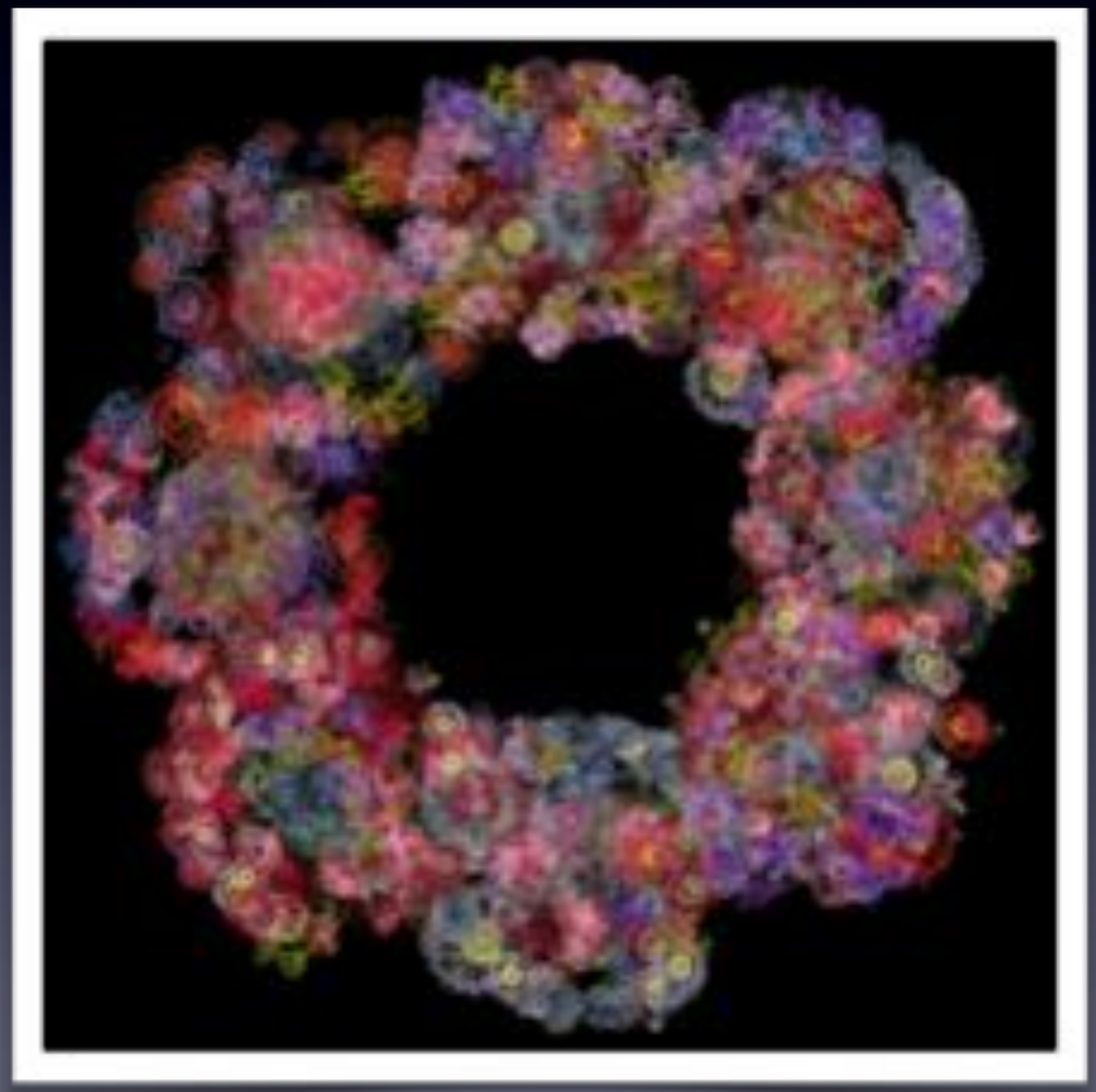
The Painting Fool

Illustrative Projects

- The creativity tripod
  - NPR, emotion detection, scene invention
- The intentionality question
  - Collage generation
- Being seen to be AI
  - Automated poetry generation

The Painting Fool
Project Overview

- Aim: to build a system which is - *one day* - taken seriously as a creative artist in its own right.



- Involves graphics (NPR), AI and vision: painting is very much a cognitive process

- Around 7 years of work (a decade of software)

www.the*painting*fool.com

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www.the*painting*fool.com

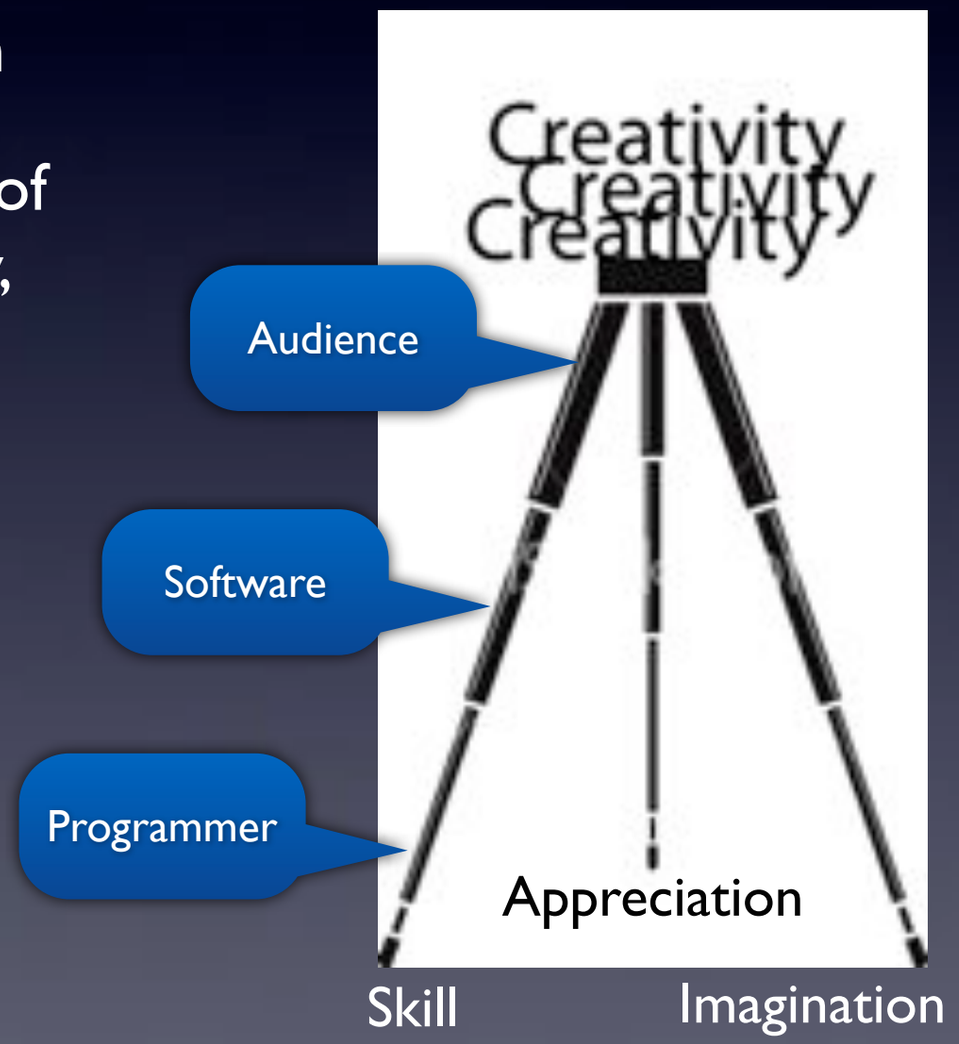
"Simulating artistic techniques means also simulating human thinking and reasoning, especially creative thinking. This is impossible to do using algorithms or information processing systems"

Strothotte and Schlechtweg
Non-Photorealistic Computer Graphics
Morgan Kaufmann, 2002

Handing Over

Creative Responsibility

- Generation is, of course, a creative responsibility, but we already know that software can be guided to generate valuable artefacts, so we don't learn much
  - We're more interested in reducing the amount of guidance, by handing over creative responsibility, which I call *Climbing the Meta-Mountain*
- We tend to do this by implementing behaviours along one of three axes:
  - Skill, appreciation and imagination
  - *The Creativity Tripod*
  - If software doesn't exhibit all three behaviours, it's easy to criticise it as being uncreative



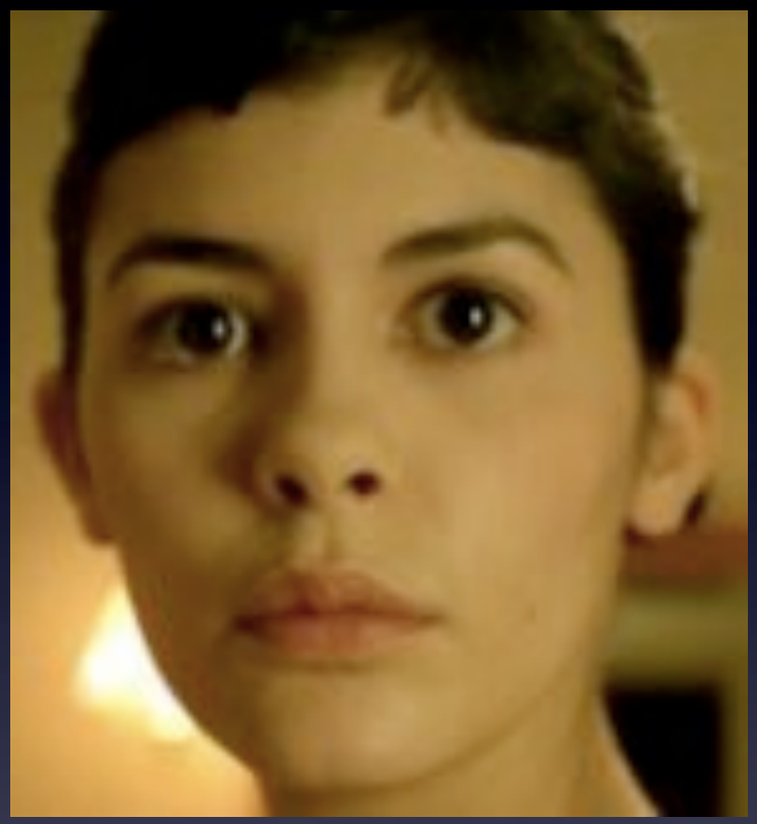
Skill

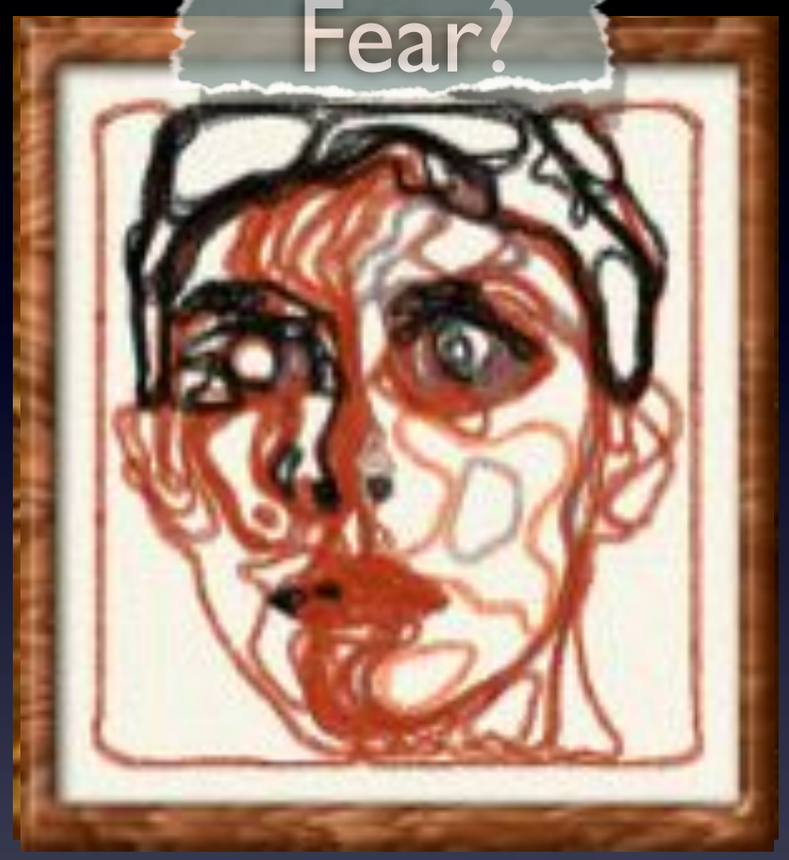
Build a non-photorealistic rendering system for photos. Uses image filtering, image segmentation, curve fitting, natural media simulation, filling routines, transformations, etc.

Boring graphics stuff...

Amelie's Progress Gallery

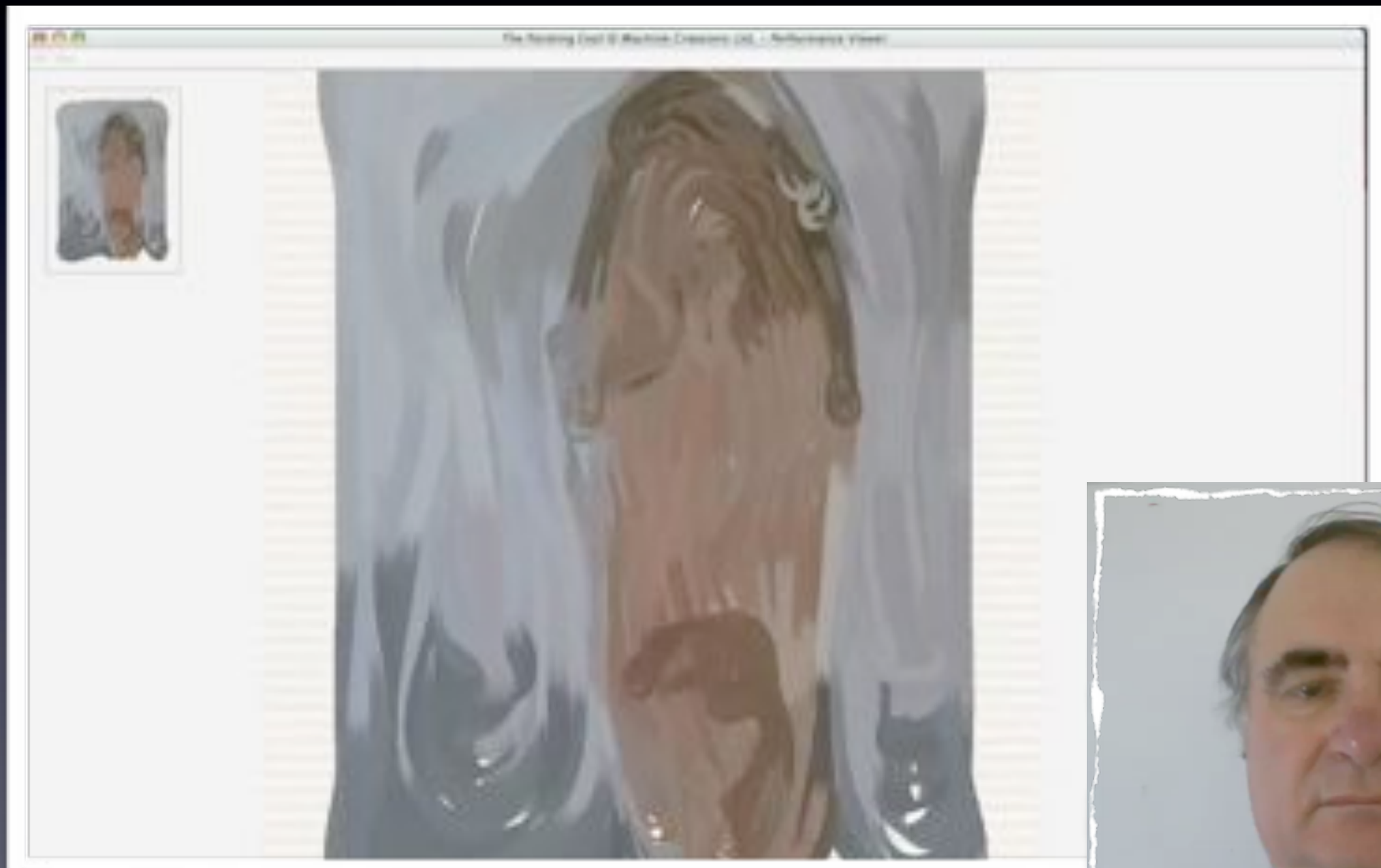
222 pictures from 22 images; emotional direction





Close Ups

Appreciation



Imagination

Scene Invention

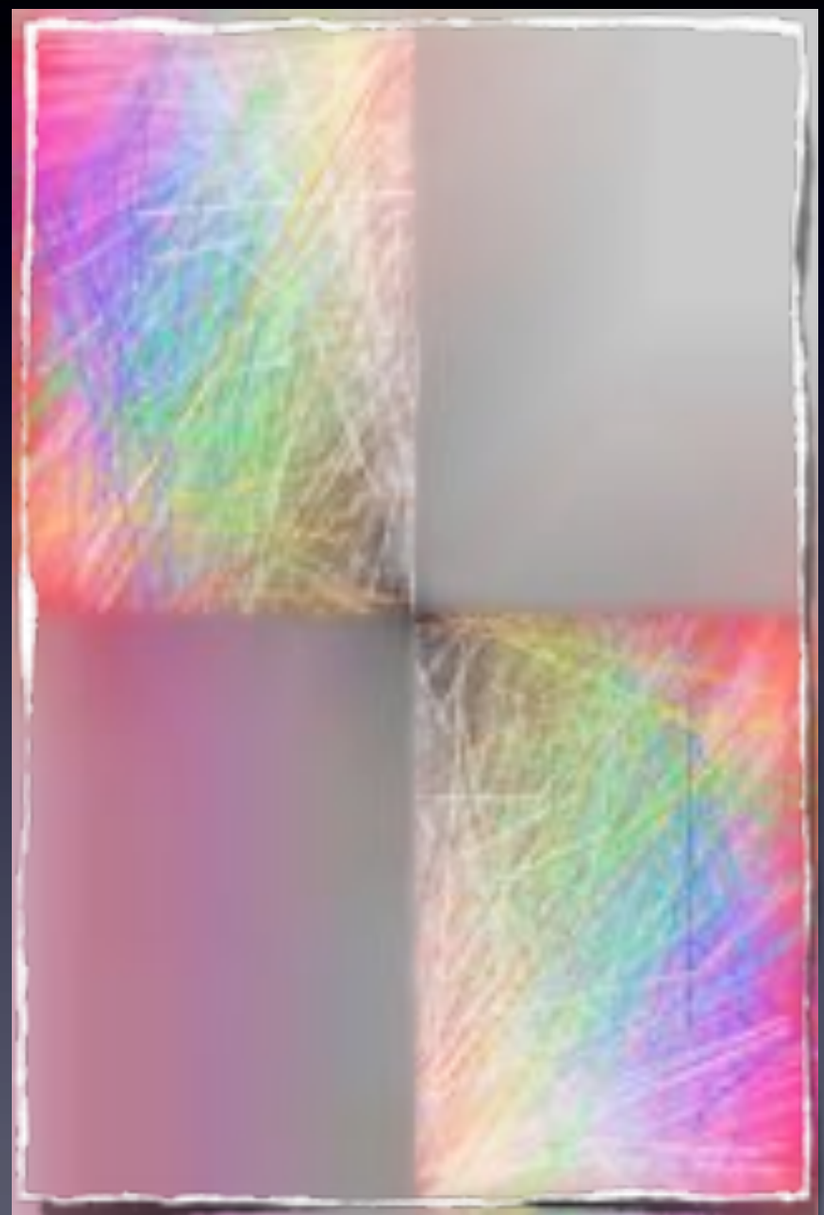
- To address (in a small way) the question of software acting imaginatively, we have given The Painting Fool lots of abilities to invent scenes from a perceived imagination
- AI techniques, including
  - Constraint solving, machine learning, evolutionary approaches, context free design grammars
- Wrapped into a teaching interface

Eve nes

www.thepaintingfool.com
Flower Arrangement #2 by The Painting Fool

Evolutionary Approaches

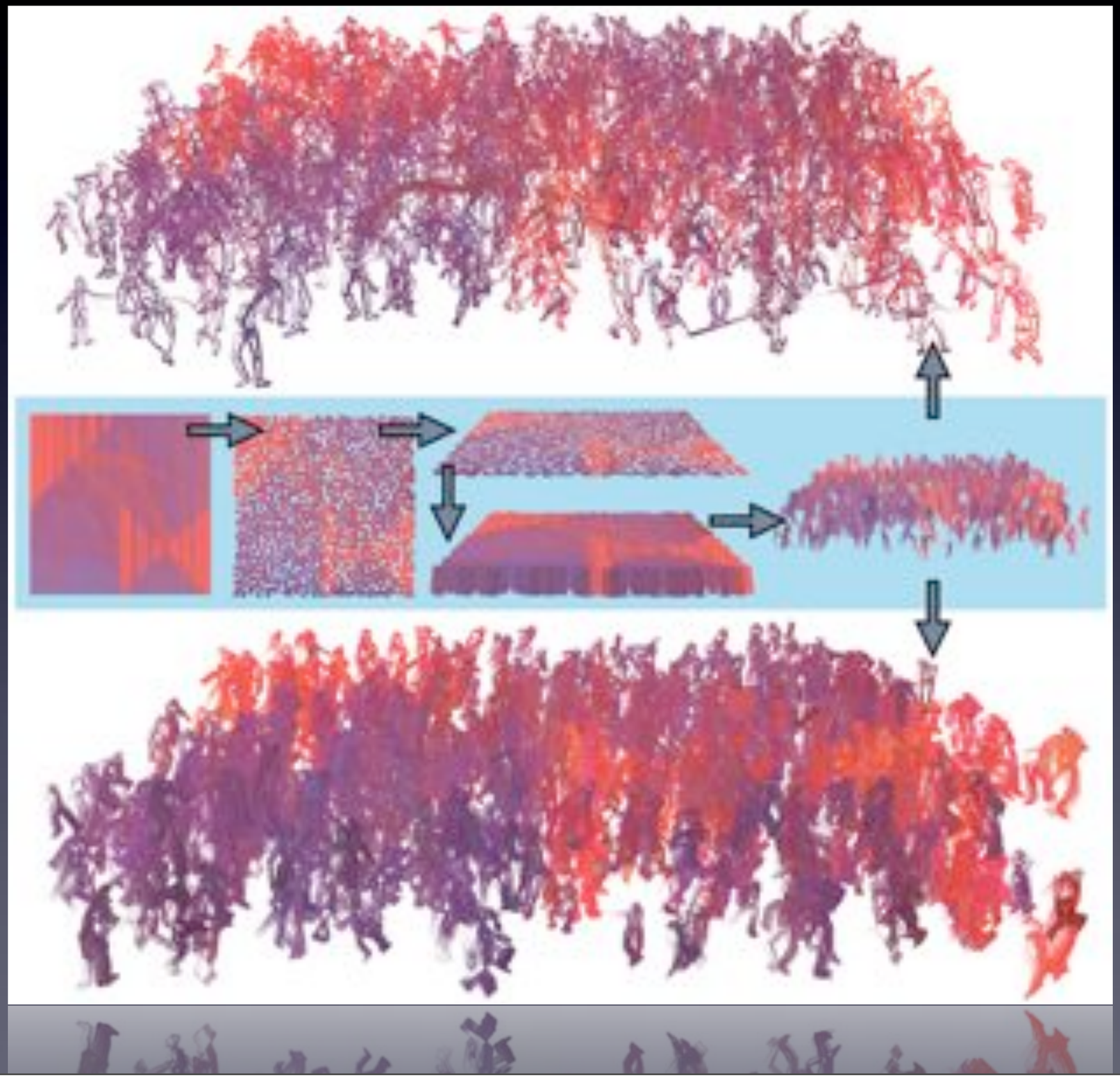
Maths Based Art



Constraint Solving

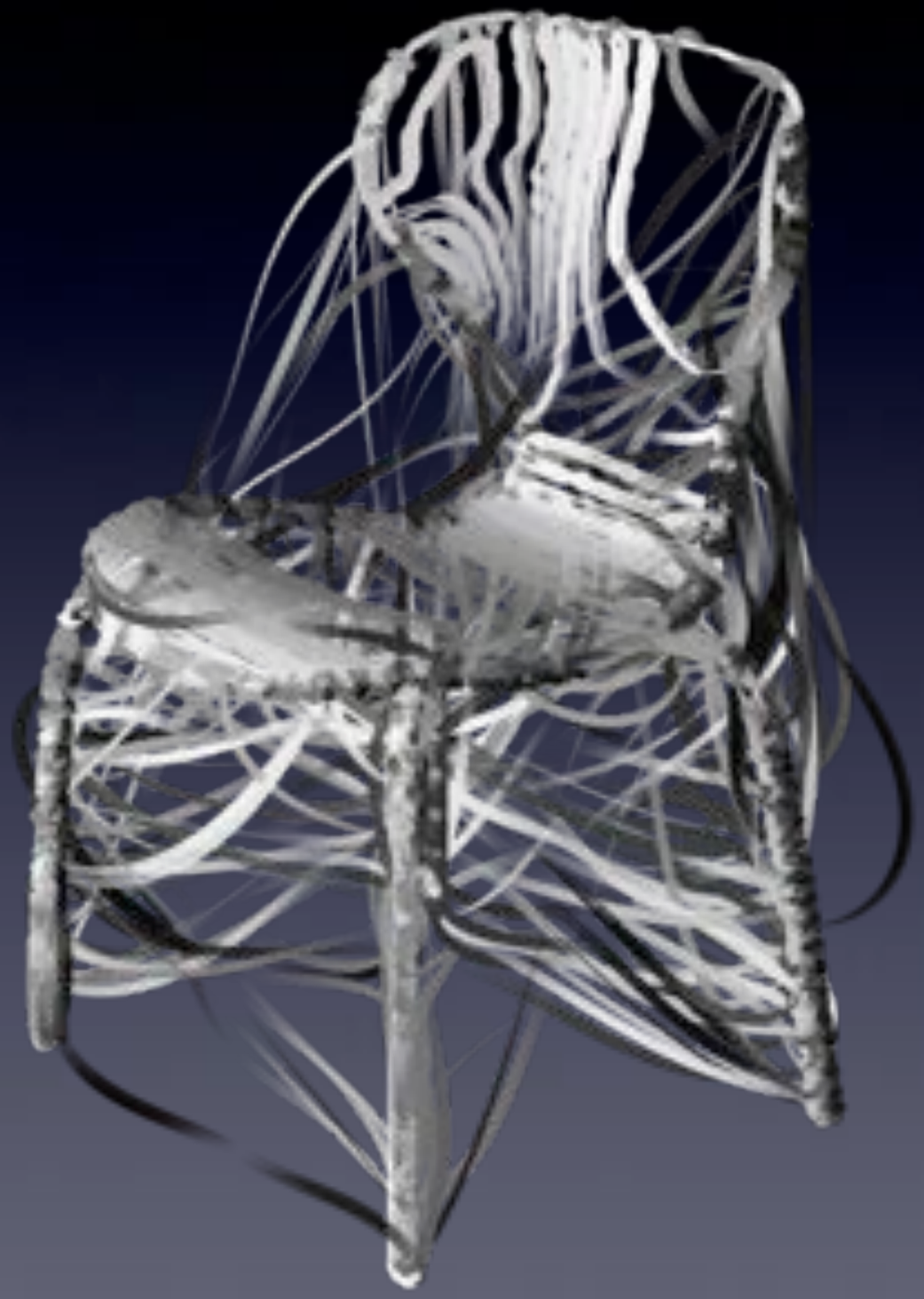
Shape Grammars

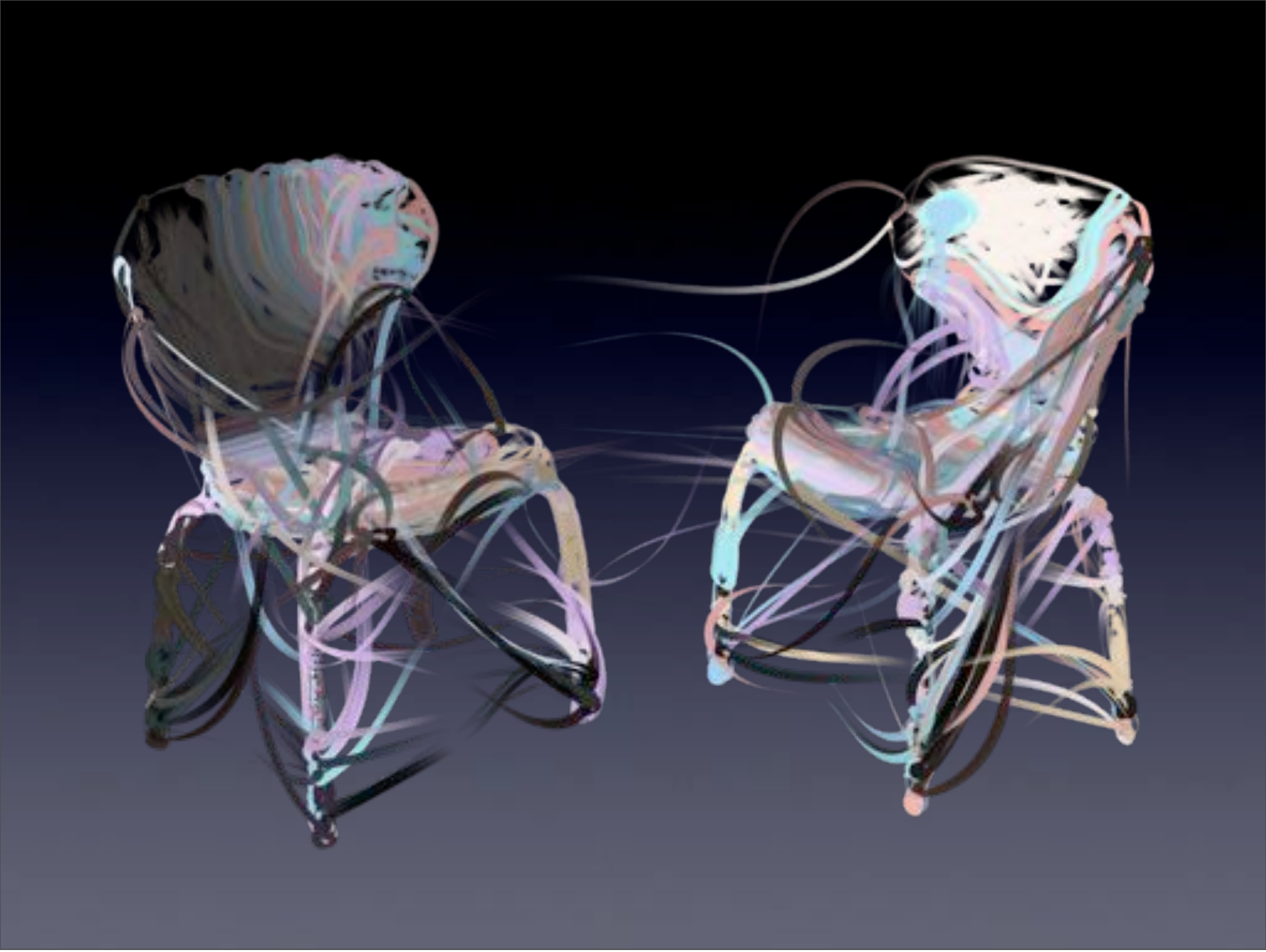
Machine Learning



Sculptures

3D Scene Generation





Gallery Design

Paint Dance Animations

Physical Pieces

The Dancing Salesman Problem

The Dancing Salesman Problem
From the *No Photos Harmed* exhibition
April 2011

Feedback

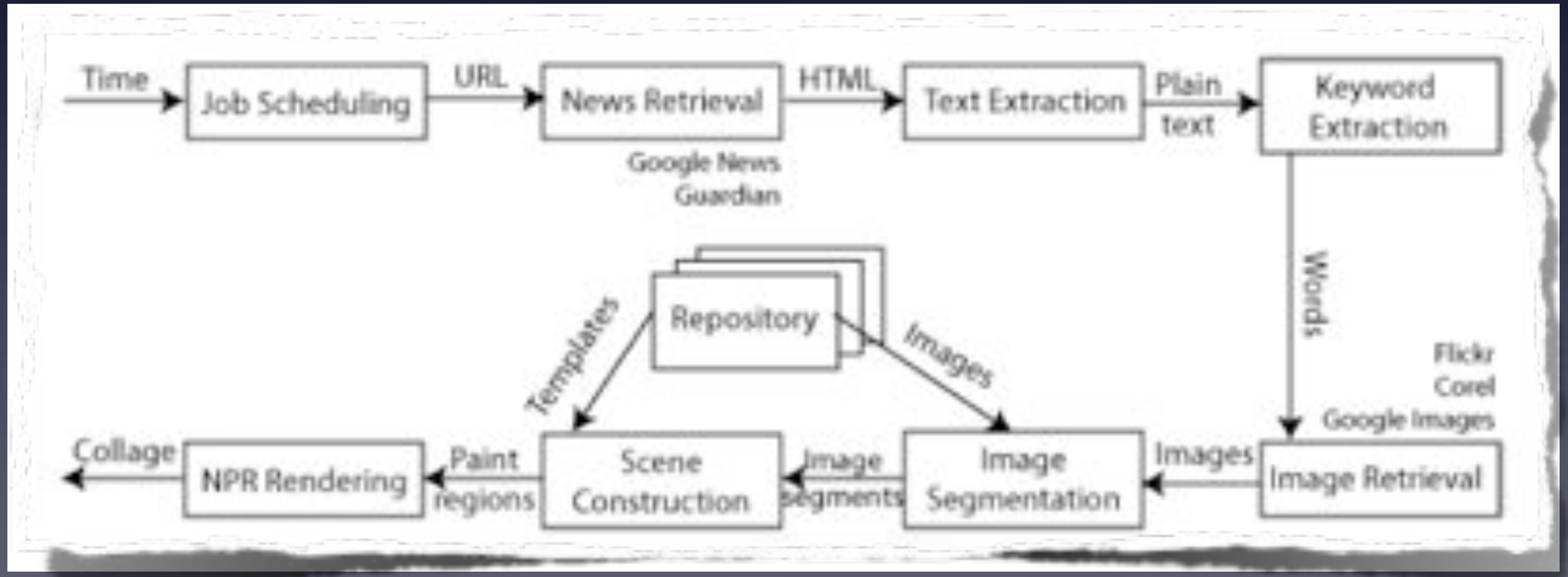
- Live demonstrations were “mesmerising”
  - People were surprised that the software chose and rendered each paint stroke
- Overall professional production standards were highly commended
  - Some people initially thought they were real paintings
- Numerous questions wanting quantification of the amount of creativity exhibited by the system
  - (Somewhat arbitrarily): 10% by software, 90% by me
  - Led to introduction of “Latent Heat of Computational Creativity”

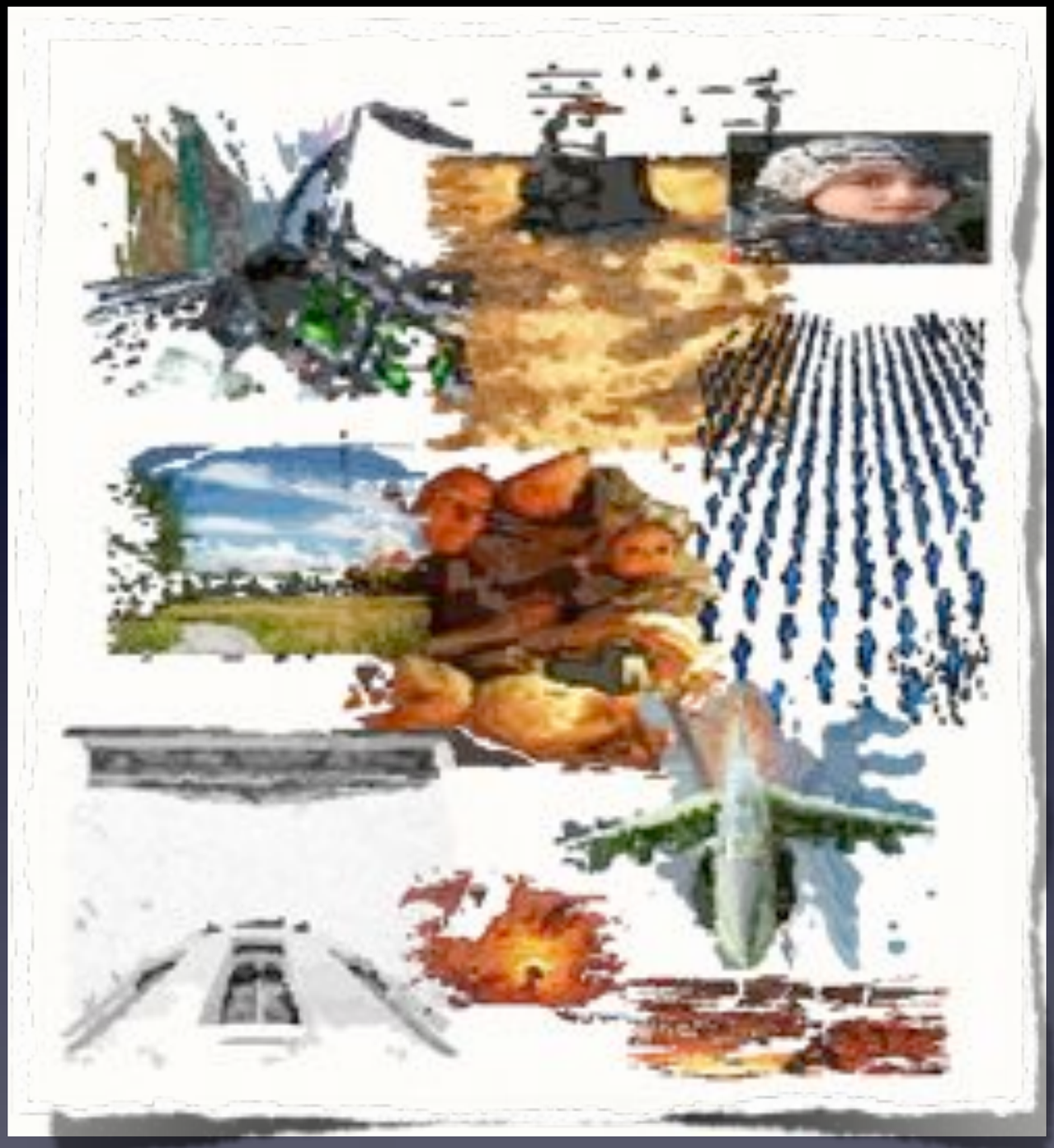
Tuesday, 30 October 12

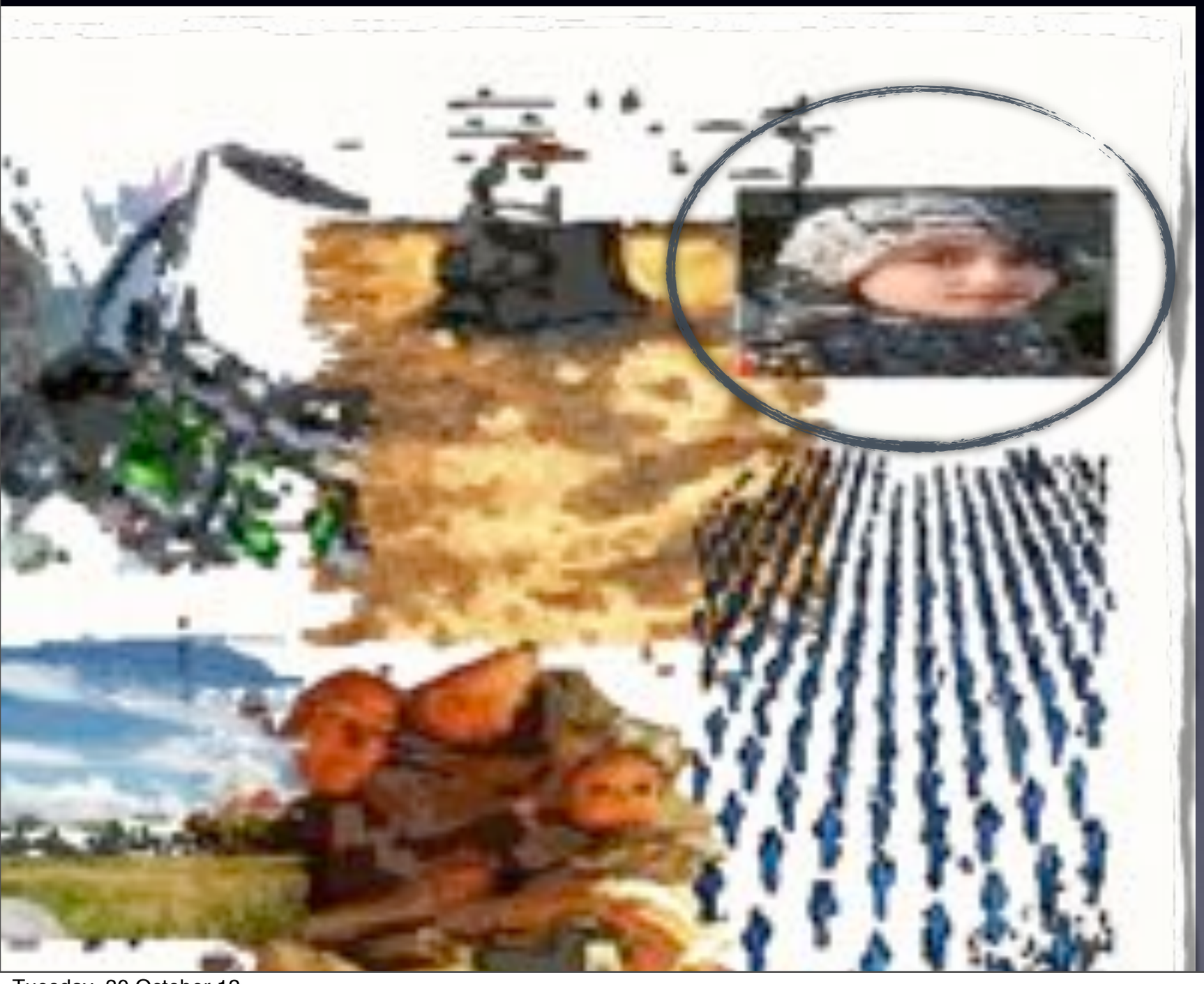
The Intentionality Question

Collage Generation

- Software is criticised as not being creative, as it never intends to do anything







Tuesday, 30 October 12

ANGELINA

www.gamesbyangelina.org

- PhD project of Michael Cook
- Aims to automatically generate interactive video games from cultural influences such as newspaper articles
- And test the hypothesis that co-operative co-evolution of species can be fruitfully employed to tackle generative design problems
- Peter Mandelson was caught illegally logging in Indonesia...

The Conservation Of Emily
Press Space To Begin

Yavalath

- Nestorgames sells a physical version of Yavalath, which was invented by the LUDI system of Cameron Browne
- There is anecdotal evidence that the computer invention of the game is actually a good selling point
- Cameron won the "Humies" gold award at GECCO this year

Being Seen to Be AI

Automated Poetry Generation

- Creative software cannot just produce valuable artefacts (poems, sonatas, theorems, paintings)
    - It has to do so in intelligent and difficult to follow ways (not necessarily randomly)
        - And it needs to convince audiences that it has behaved in interesting and creative ways
- Will hopefully turn a vicious circle into a virtuous circle
- Practical implications:
    - Software should produce commentaries, and ultimately be able to answer questions...

Circadian No. 39

[ ] [ ] of a [ ],
[ ] [ ] of a [ ].

In the morning, I am [ ]
Like the [ ] of a [ ].
But the morning grows more [ ]
Than the [ ] of a [ ].
And the mid-day makes me [ ]
Like the [ ] of a [ ].

Active [ ] of a [ ],
[ ] [ ] of a [ ].

In the daytime, I am [ ]
Like the [ ] of a [ ].
But the sunlight grows more [ ]
Than the [ ] of a [ ].
And the day, it makes me [ ]
Like the [ ] of a [ ].

[ ] [ ] of a [ ],
[ ] [ ] of a [ ].

In the [ ], I am [ ]
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[ ] [ ] of a [ ],
[ ] [ ] of a [ ].

In the night-time, I am [ ]
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But the moonlight grows more [ ]
Than the [ ] of an [ ].
And the darkness makes me [ ]
Like the [ ] of a [ ].

[ ] [ ] of a [ ],
[ ] [ ] of a [ ].

Circadian No. 39

Stealthy swiftness of a leopard,
Happy singing of a bird.

In the morning, I am loyal
Like the comfort of a friend.
But the morning grows more lifeless
Than the fabric of a rag.
And the mid-day makes me nervous
Like the spirit of a bride.

Active frenzy of a beehive,
Dreary blackness of a cave.

In the daytime, I am slimy
Like the motion of a snake.
But the sunlight grows more comfy
Than the confines of a couch.
And the day, it makes me tasty
Like the flavor of a coke.

Shiny luster of a diamond,
Homey feeling of a bed.

In the evening, I am solid
Like the haven of a house.
But the evening grows more fragile
Than the mindset of a child.
And the twilight makes me frozen
Like the bosom of a corpse.

Famous fervor of a poet,
Wily movement of a cat.

In the night-time, I am hollow
Like the body of a drum.
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da da da da di di da da
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da da da da di di daaa
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Repetition | Frequency | Stemming | Metre

Searching Questions #1

- D
  c
- D
  P
- V

about these constraints, and throw in some more stuff?

My point is:

There are possibly benefits (in terms of increased value projected onto the artefacts) to be gained by presenting explicit information about the process behind the generation of an artefact

We can provide this information through technical papers, talks and notes, but it would be better for the software to do this itself, because it simulates appreciation and/or reflection, which we value in creative people

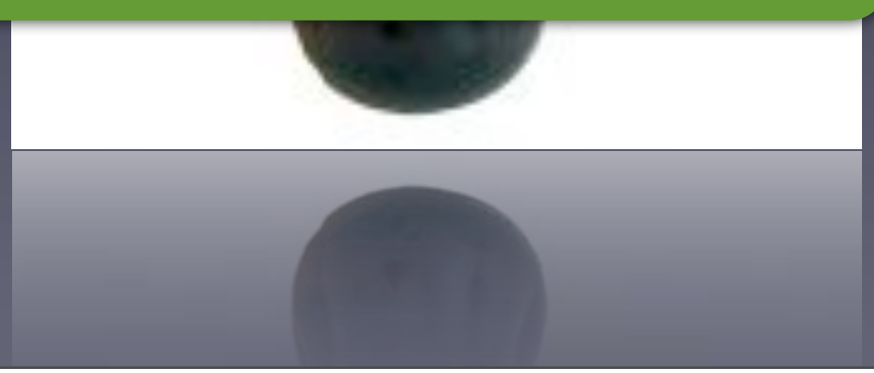
Rhyme | Non-rhyming | Sentiment | Advertising

Searching Questions #2

My point is:

There may be a virtuous circle (rather than the usual vicious circle) we can get into, if we know that the software has done something difficult and intelligent. People will always read/see/hear things that aren't in artefacts by design. If those people know a little about the intelligence of the system, then they might be prepared to give software the benefit of the doubt

Software could make stuff up (tell a story...)



Searching Questions #3

- n”?
- This doesn’t feel like Computational Creativity research yet
- The software needs to take on more creative responsibility ’?

My point is:

This is a clearly a Simon-generated poem

in the production of the poems...

Handing over Creative Responsibility

The FACE Model

- We can judge progress in terms of the types of generative acts that software undertakes (regardless of the value of its output)

See our ICCC'11 papers

- Examples - simile multiplication, phrase overlapping
- Concepts - generating templates
- Aesthetics - inventing measures of value
- Framing - producing a commentary

Handing over Creative Responsibility

Poetry Generation Pipeline

Content

All Guardian newspaper articles for the day assessed for sentiment

Good or bad mood day determined

Specific article chosen

Keyphrases extracted

Database of similes

Variations of similes

Phrases overlapped

Value

Appropriateness

Relevance

Flourishes

Lyricism

Aesthetic measure for the day

Form

Template Generated

Example poems produced

Final poem selected

Handing over Creative Responsibility

Commentary Generation

- Many aspects of the content, value and form parts of the pipeline for the poem were recorded for usage in a template commentary, including:
  - Details about the mood of the day
  - Details about the Guardian article (title, day, section)
  - Details about the keyphrases extracted and the full sentences they came from
  - Details about the aesthetic measures used
- Title chosen as the most-used keyphrase

New Poems...

It was generally a good news day. I read a story in the Guardian culture section entitled: "South Africa's ANC celebrates centenary with moment in the sun". It talked of south africans, interfaith prayers and monochrome photos. Apparently, "The heroic struggle against a racist regime was remembered: those thousands who sacrificed their lives in a quest for human rights and democracy that took more than eight decades" and "At midnight he watched with amusement as Zuma lit the centenary flame, at the second attempt, with some help from a man in blue overalls marked 'Explosives'". I wanted to write something highly relevant to the original article. I wrote this poem.

Blue overalls

the repetitive attention of some traditional african chants
a heroic struggle, like the personality of a soldier

an unbearable symbolic timing, like a scream
blue overalls, each like a blueberry
some presidential many selfless leaders

oh! such influential presidents
such great presidents
blueberry-blue overalls

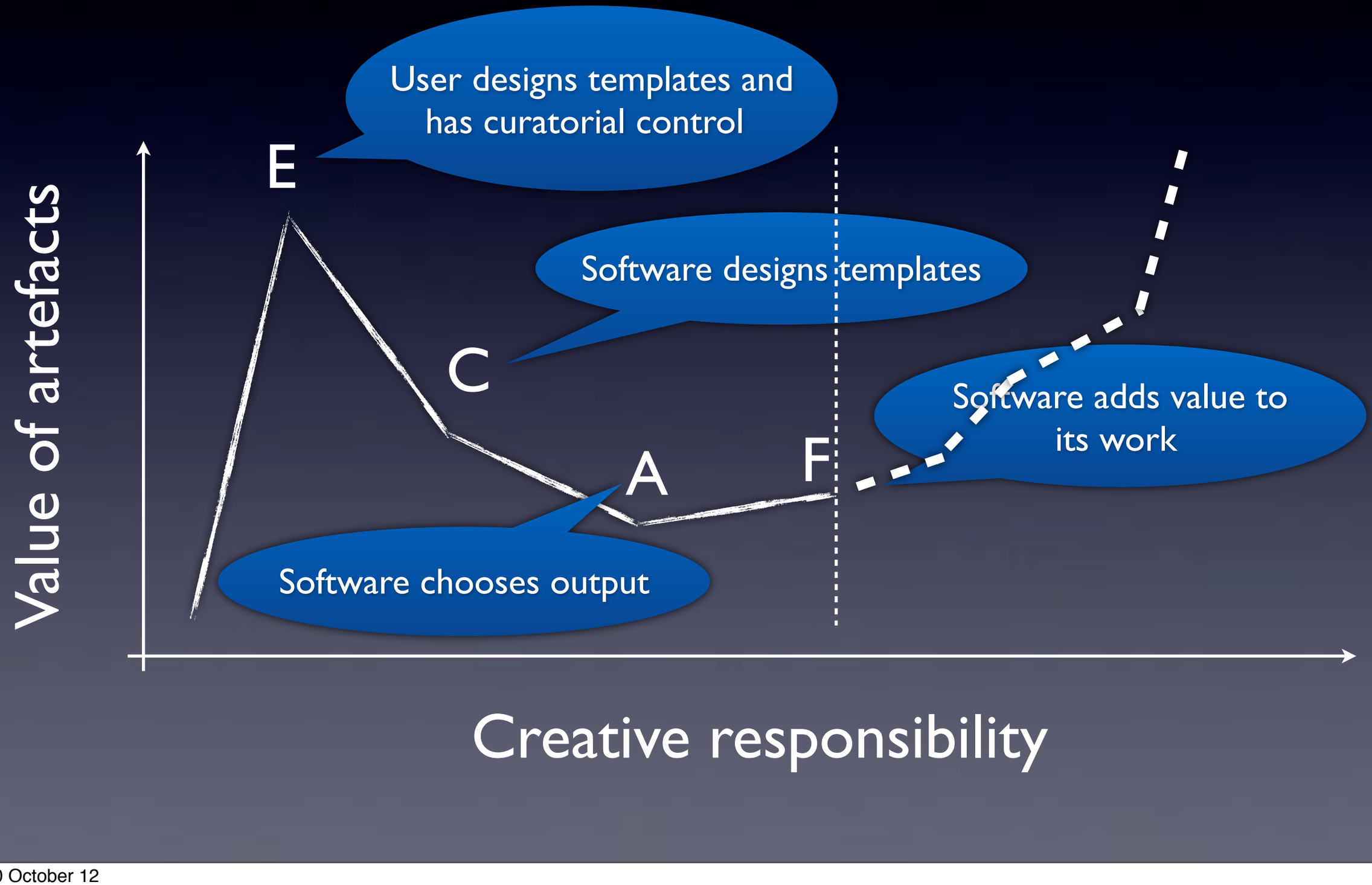
lark-blue overalls
a knight-heroic struggle

Discussion...

- Taken out of context, e.g., in an evaluation test or a Turing-style test, poem #1 would probably score higher as a "poem shaped object" than poem #2
- But, when we read about *how* the software produced the poems, it's likely that people will project more creativity onto the software producing poem #2
- So, the more sophisticated software represents a backward step in automated poetry generation, but an advance in computational creativity
  - The Latent Heat effect in Computational Creativity

The Latent Heat Effect

in Computational Creativity



Into the Future...

Summary So Far

- When handing over creative responsibility, we need to consider skill, appreciation and imagination
- Handing over creative responsibility can lead to lower quality artefacts being produced
- Unlike in other areas of AI based on problem solving scenarios, creative software has to justify what it has done and why it has done it

Climbing the meta-mountain using the creativity tripod

The latent heat problem in Computational Creativity

Being seen to be AI

Turing-Style Imitation Tests

- OK... Software isn't human!
- Most suggested "Turing Tests" in the arts don't involve the dialogue aspect. This suggests that creativity is skin deep and ignores process. This can alienate people in the arts
- Imitation is antipodal to being creative - software should aim to create new things in new ways, not like anyone or anything else
  - Imitation tests obviously encourage pastiche
  - Imitation tests can encourage naivety (to simulate human fallacies)
- We should be loud and proud about the computational history of the artefacts produced
  - We should be aiming for software to be creative in non-human ways
- Turing-style tests often actually serve to emphasise the *humanity gap*

Introduction

Mainstream poetry is a particularly human endeavour: written by people, to be read by people, and often about people. Therefore – while there are some exceptions – audiences expect the opportunity to connect on an intellectual and/or emotional level with a person, which is often the author. Even when the connection is made with characters portrayed in the poem, the expectation is that the characters have been written from a human author's perspective. In the absence of information about an author, there is a default, often romantic, impression of a poet which can be relied upon to provide sufficient context to appreciate the humanity behind a poem. Using such an explicit, default or romantic context to enhance one's understanding of a poem is very much part of the poetry reading experience, and should not be discounted.

The Humanity Gap

Software isn't human

People often want the human connection when they consume creations

There is a default assumption about non-creativity in software and a vicious circle

When people evaluate artefacts, they are really evaluating the creative act which produced it, in particular the processes involved

Created artefacts are invitations to a dialogue

To add drama, creative people often introduce elements of fiction into their explanations

Some facts...

Filling the Humanity Gap #1

Showing Intelligence

The Humanity Gap

Software itself needs to tell people about how/why it has been creative. This can include elements of fiction

Need first to show that software is intelligent, then simulate other aspects: intentionality, motivation, cultural awareness

Framing information: titles, snippets

Commentaries

Stories

Dialogue systems

Filling the Humanity Gap #2

Admitting Differences

- If we can admit that software and people are different creative beings, and that how artefacts are produced and by whom/what are integral part of the artefacts...
- ...then we should acknowledge computer generated artefacts as being fundamentally different to those produced by people...
- ...and we should drop any pretence that it's useful to compare human and computer generated artefacts
- ...so that we can concentrate on assessing progress in our research and exploring the possibilities for non-human creative behaviour

Filling the Humanity Gap #3

Adding Sophistication

- Appreciation
  - Need to have much more sophisticated models of how created artefacts might affect audiences intellectually and emotionally
  - Software should know that Mandelson+cute animals+scream = emotional impact
- Imagination
  - Need to move from rough approximations blurring the lines of intentionality to full idea generation

A Sketch Approach

The What-If Machine

Internet Resources — Newspaper articles, social media, video sites, ontologies, databases, APIs, etc

Ideation Module — Production rule-style generation of ideas informed by the other modules

Rendering Modules — Different renderers for each different type of artefact (painting, poem, music, ...)

Evaluation Module — "Imaginative reasoning" as a combination of deduction, constraint solving, common sense, etc.

Our Working Definition of an Idea

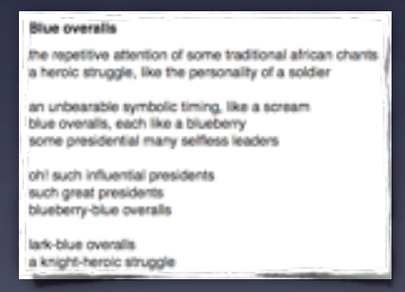
- An idea is a data structure which can be used to guide the generation of two things:
  - An artefact such as a painting, poem, hypothesis, piece of prose, musical composition, etc.
  - A commentary about the motivations, processes, contexts, aesthetic considerations, etc., behind the creative act of producing the artefact

I wanted to show that he
was very sad at that moment

I wanted to get across the terrible destruction in Afghanistan, in particular the effect it has on families

I wanted to capture the
liveliness of a dance floor

I wanted to portray the real poignancy but highlight the fun of the night



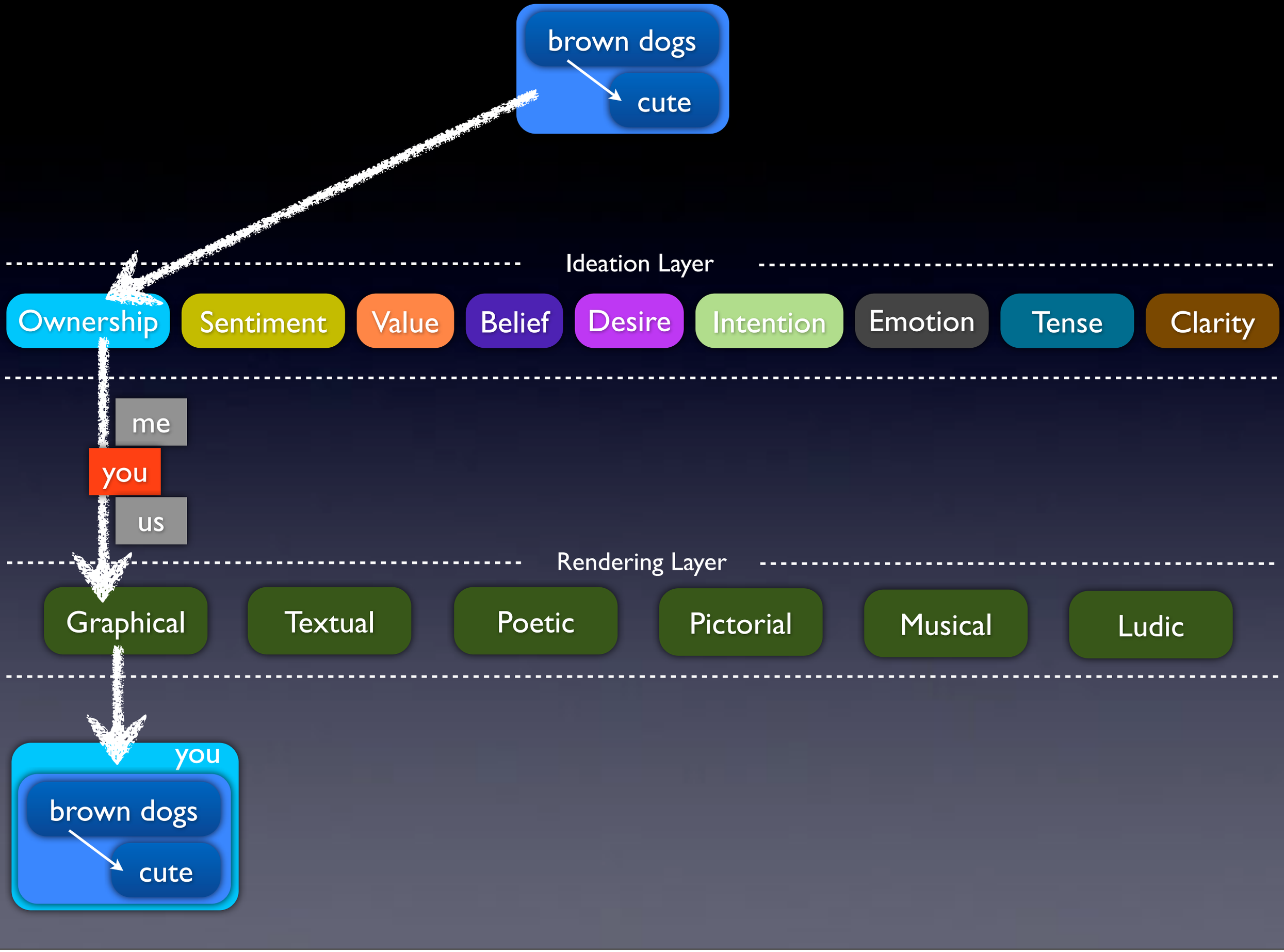
I wanted to capture the ill feeling
there is towards Peter Mandelson

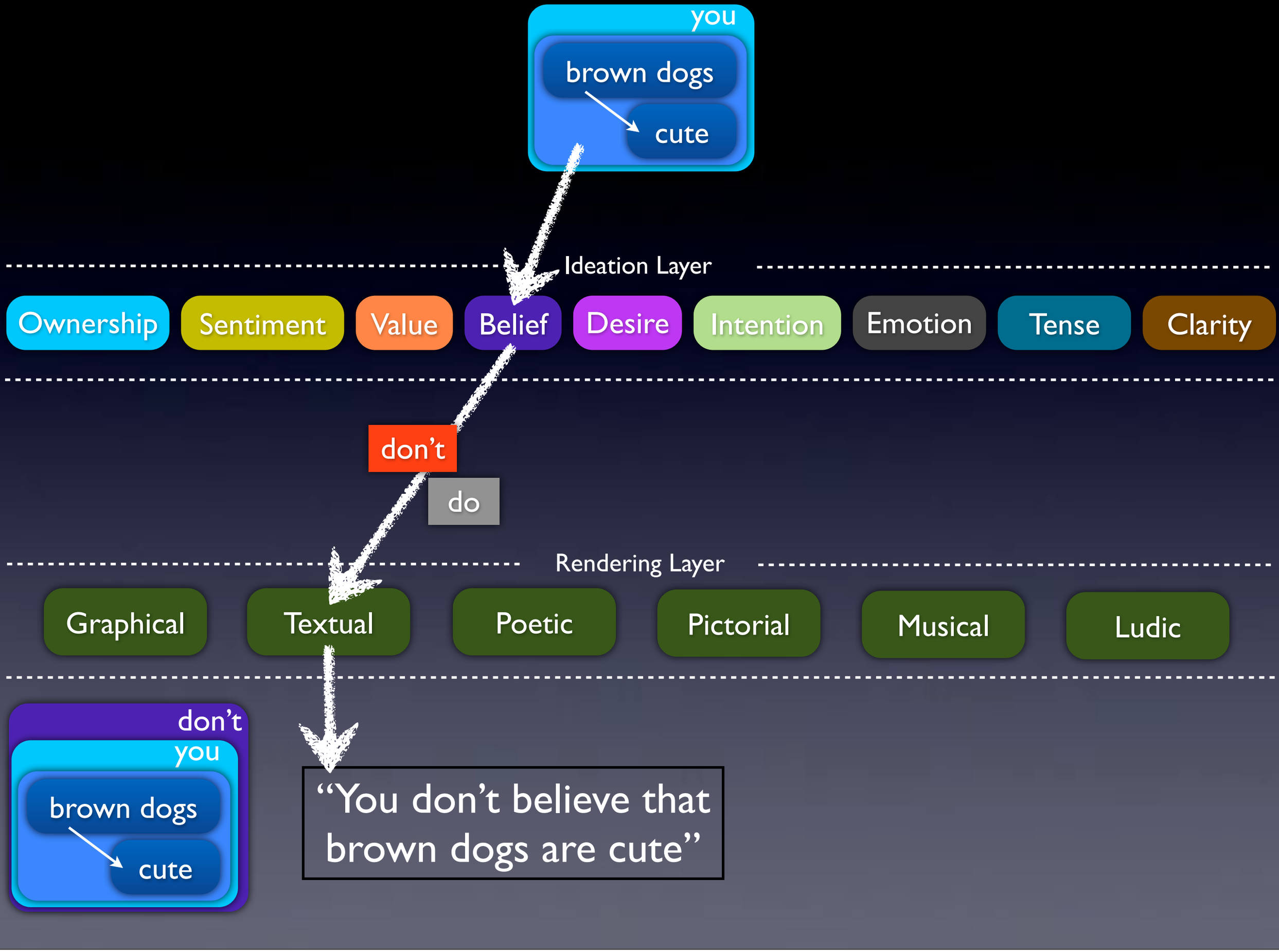
Base types for Ideas

- Ideas which could be formed using existing AI methods:
  - An example: *Rocky the dog*
  - A concept: *brown dogs*
  - A relationship: *brown dogs are cute*
- We could also use some simple templates
  - An agent performing an action
  - An agent expressing an emotion

Ideation Rules

- Standard production rules could be used to combine ideas, e.g., conjunction, disjunction, composition, negation, instantiation, etc.
- Could also use counter-factual reasoning
- Some possibilities for further developing ideas by adding (or changing):
  - Ownership, tense, sentiment, emotion, belief, desire, intention, saliency, value, ...


brown dogs
cute
Ideation Layer
Ownership
Sentiment
Value
Belief
Desire
Intention
Emotion
Tense
Clarity
me
you
us
Rendering Layer
Graphical
Textual
Poetic
Pictorial
Musical
Ludic
you
brown dogs
cute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Rendering Layer
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Poetic
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Musical
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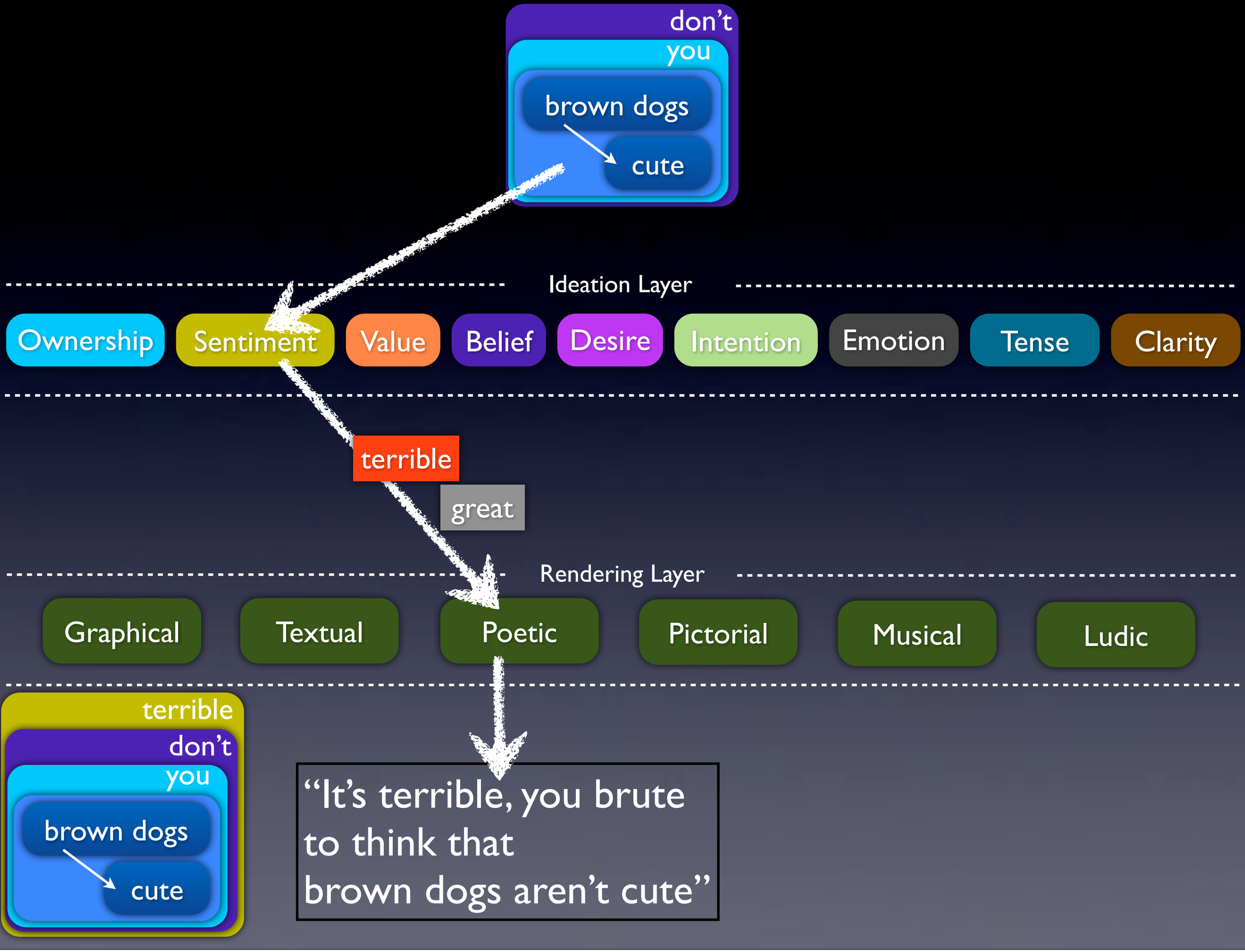
don’t
you
brown dogs
cute
“You don’t believe that brown dogs are cute”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Ideation Layer
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Belief
Desire
Intention
Emotion
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Clarity
terrible
great
Rendering Layer
Graphical
Textual
Poetic
Pictorial
Musical
Ludic
terrible
don't
you
brown dogs
cute
"It's terrible, you brute to think that brown dogs aren't cute"

terrible
don't
you
brown dogs
cute

Ideation Layer

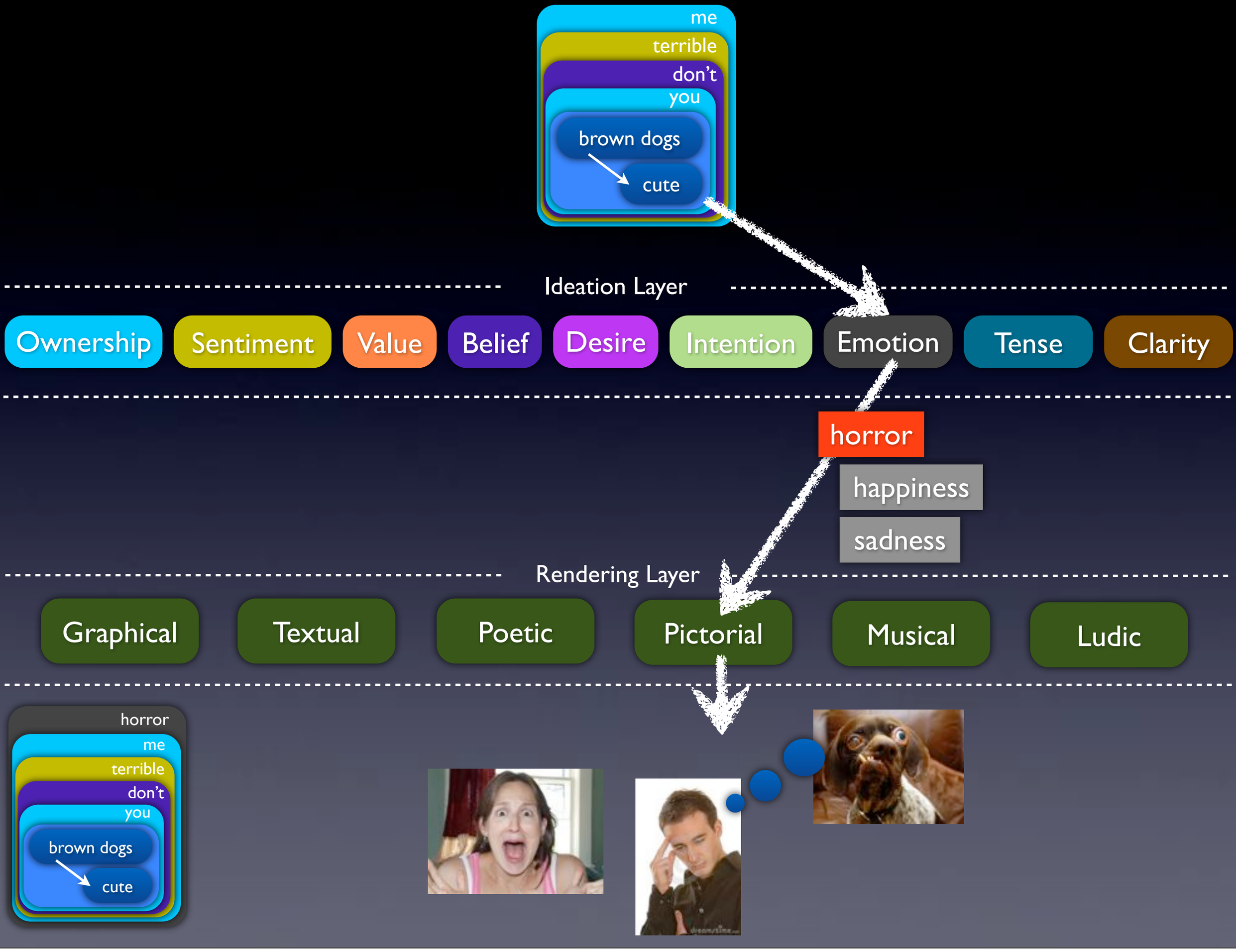
Ownership | Sentiment | Value | Belief | Desire | Intention | Emotion | Tense | Clarity

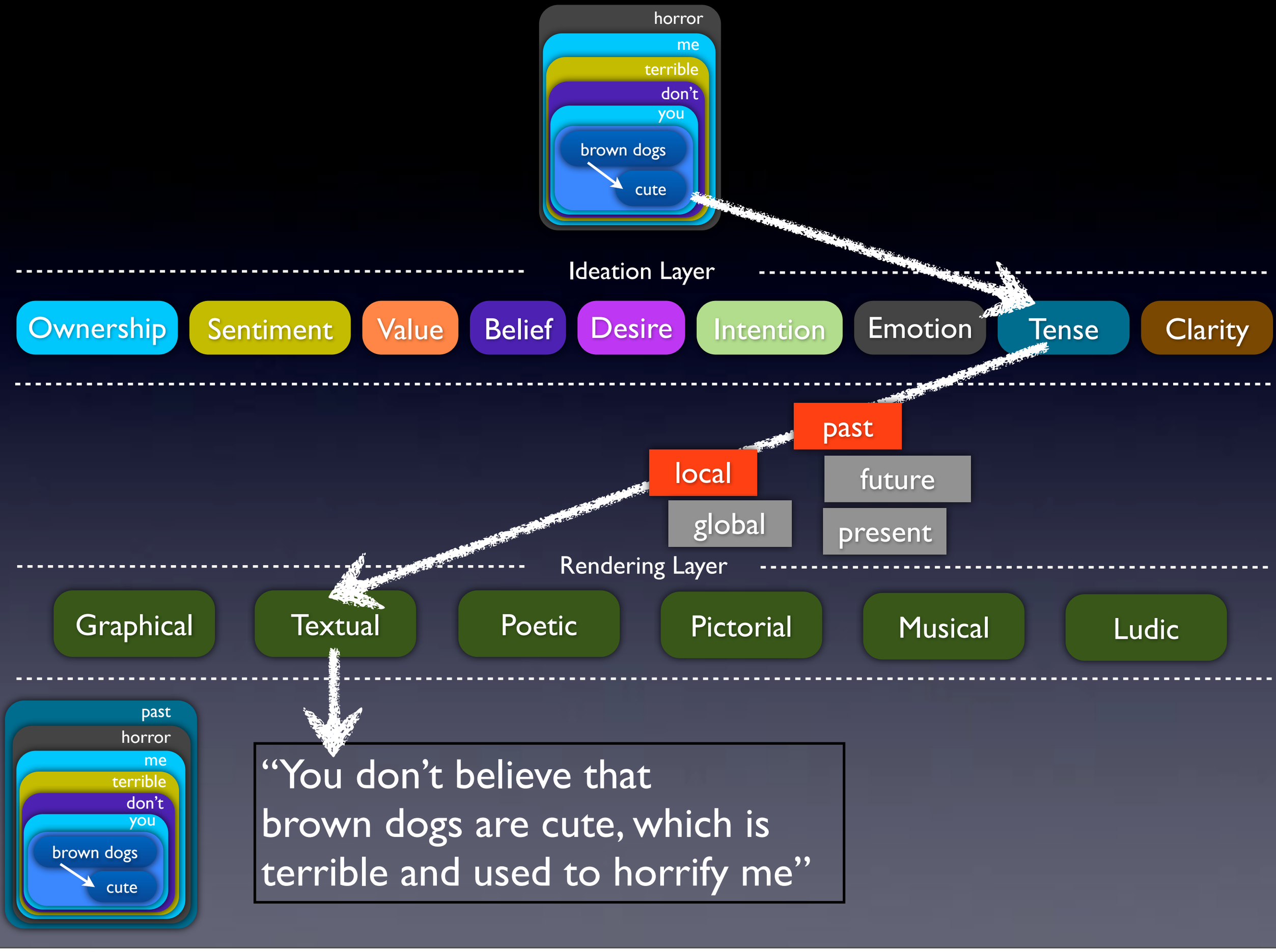
me
you
us

Rendering Layer

Graphical | Textual | Poetic | Pictorial | Musical | Ludic

me
terrible
don't
you
brown dogs
cute

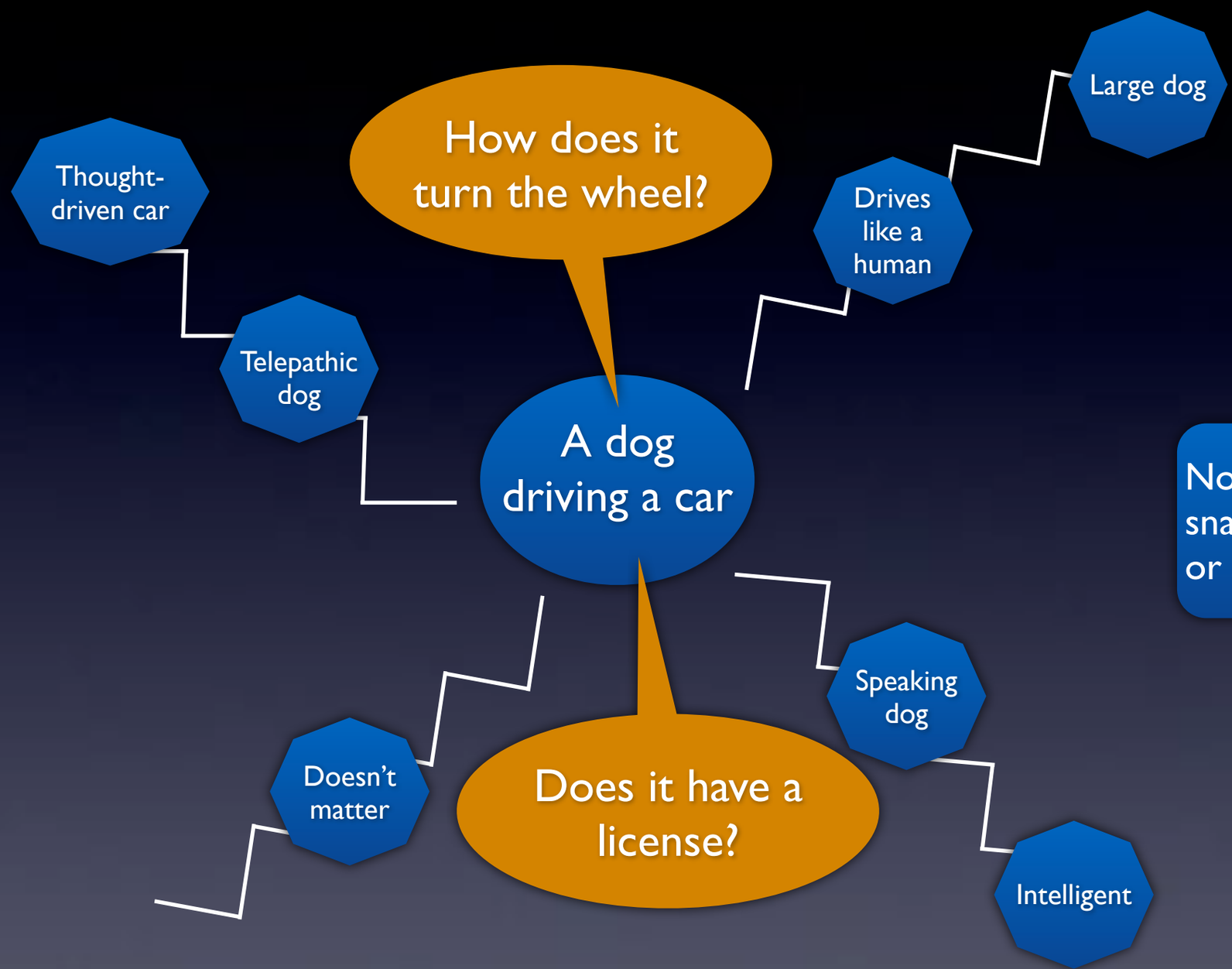

me
terrible
don't
you
brown dogs
cute
Ideation Layer
Ownership
Sentiment
Value
Belief
Desire
Intention
Emotion
Tense
Clarity
horror
happiness
sadness
Rendering Layer
Graphical
Textual
Poetic
Pictorial
Musical
Ludic
horror
me
terrible
don't
you
brown dogs
cute


horror
me
terrible
don't
you
brown dogs
cute
Ideation Layer
Ownership
Sentiment
Value
Belief
Desire
Intention
Emotion
Tense
Clarity
past
local
global
future
present
Rendering Layer
Graphical
Textual
Poetic
Pictorial
Musical
Ludic
past
horror
me
terrible
don't
you
brown dogs
cute
"You don't believe that brown dogs are cute, which is terrible and used to horrify me"

Evaluating Ideas

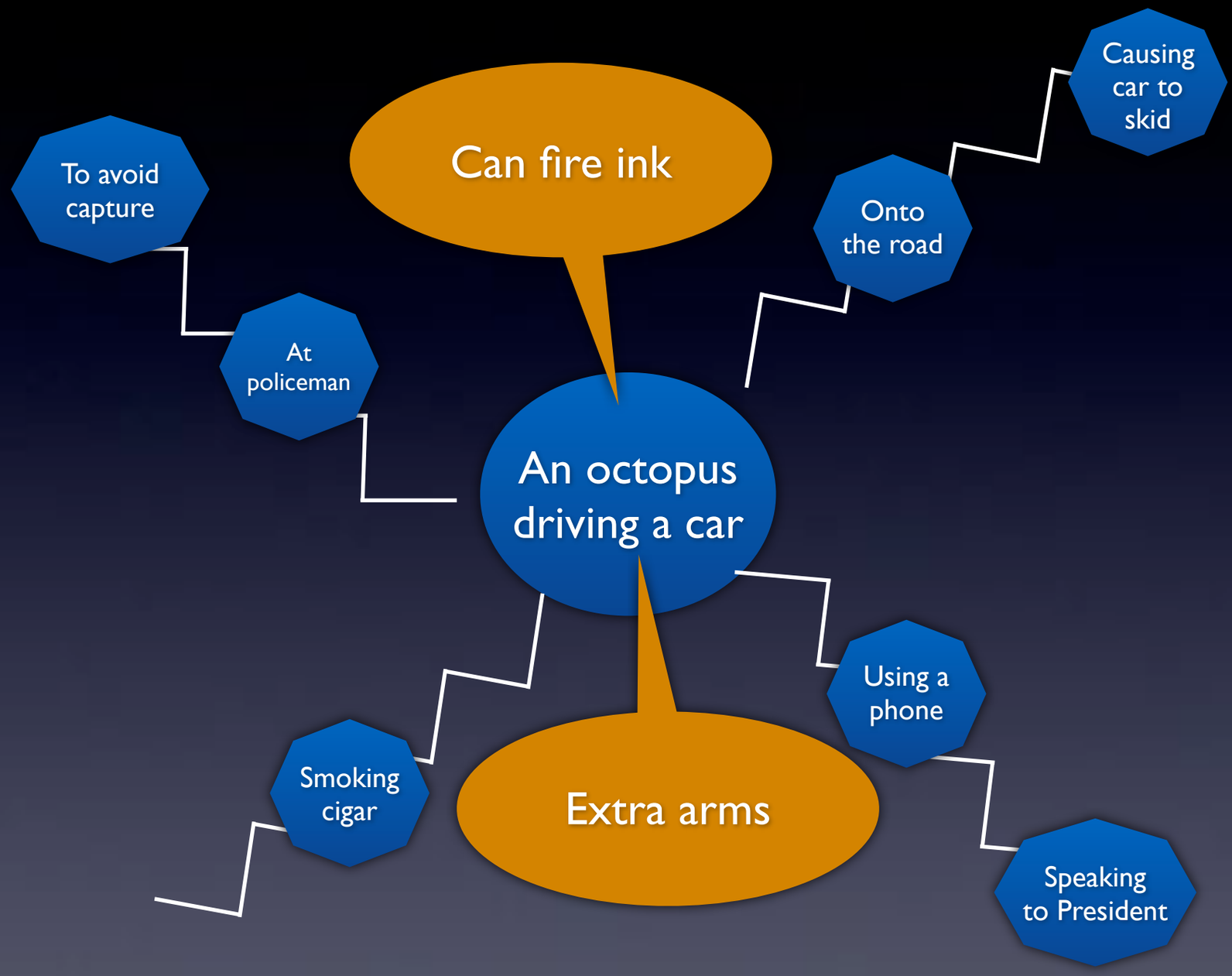
- Ideas have to be evaluated in a context, which includes details about levels of fact or fiction and which rendering is likely to be used
- Reality distortion field
  - An idea introduced into a context will have an effect on many nearby ideas - keeping the original idea constant might mean changing others
- If the idea is fictional, then there are (at least) two ripple effects in the field:
  - ***Consequences*** leading possibly to constraints which need new ideas to satisfy them
  - ***Possibilities*** of introducing new ideas to flesh out the original one
- The ripple effect can be captured by reasoning approaches - to be determined
- The context (in particular the rendering), focuses the reasoning

Reasoning about Consequences



- Can we measure how difficult it is to shoe-horn an idea into reality (as a indication of value)? A model of silliness... :-)

Reasoning for Exploitation



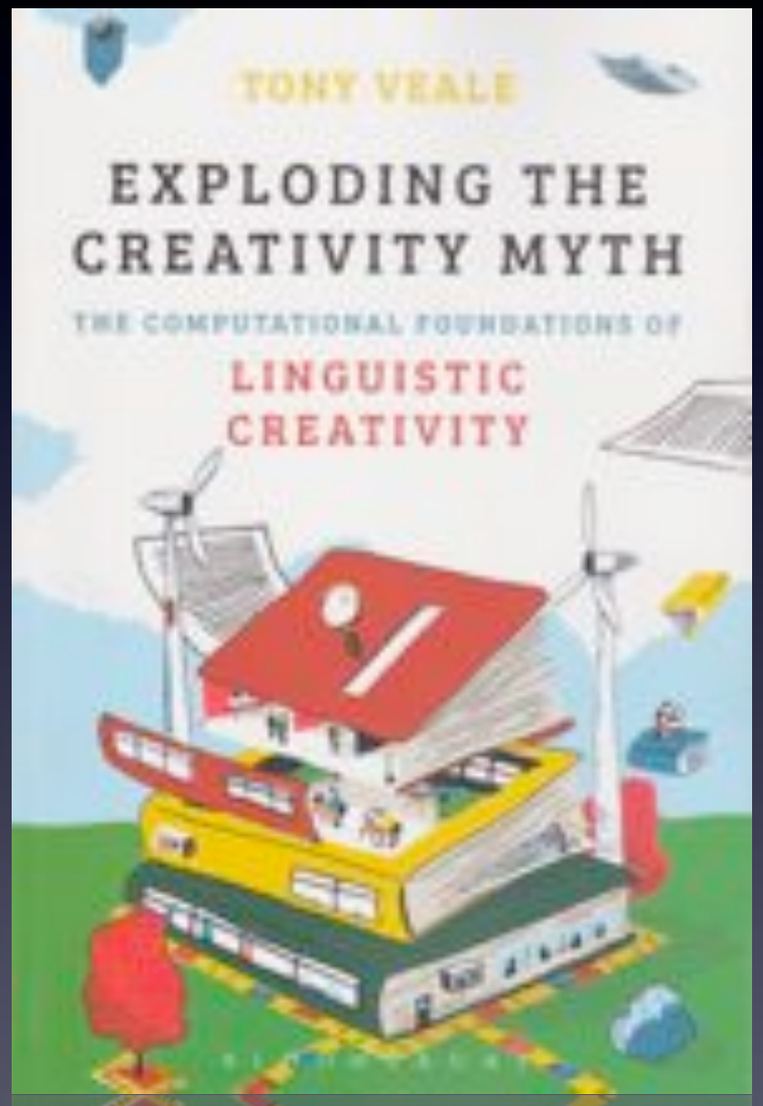
- Can we determine how many other ideas flow from an original idea, and how easy this is (as a value measure)?

Wrap Up

- Via practical projects, references to the literature (in papers) and argumentation, we've tried to point out that Computational Creativity has exciting new directions to go in
  - If we can let go of some strongly held views in AI research
- I'm interested in starting a dialogue with you about the nature of computationally generated poems and paintings

And now for a Couple of Shameless Plugs

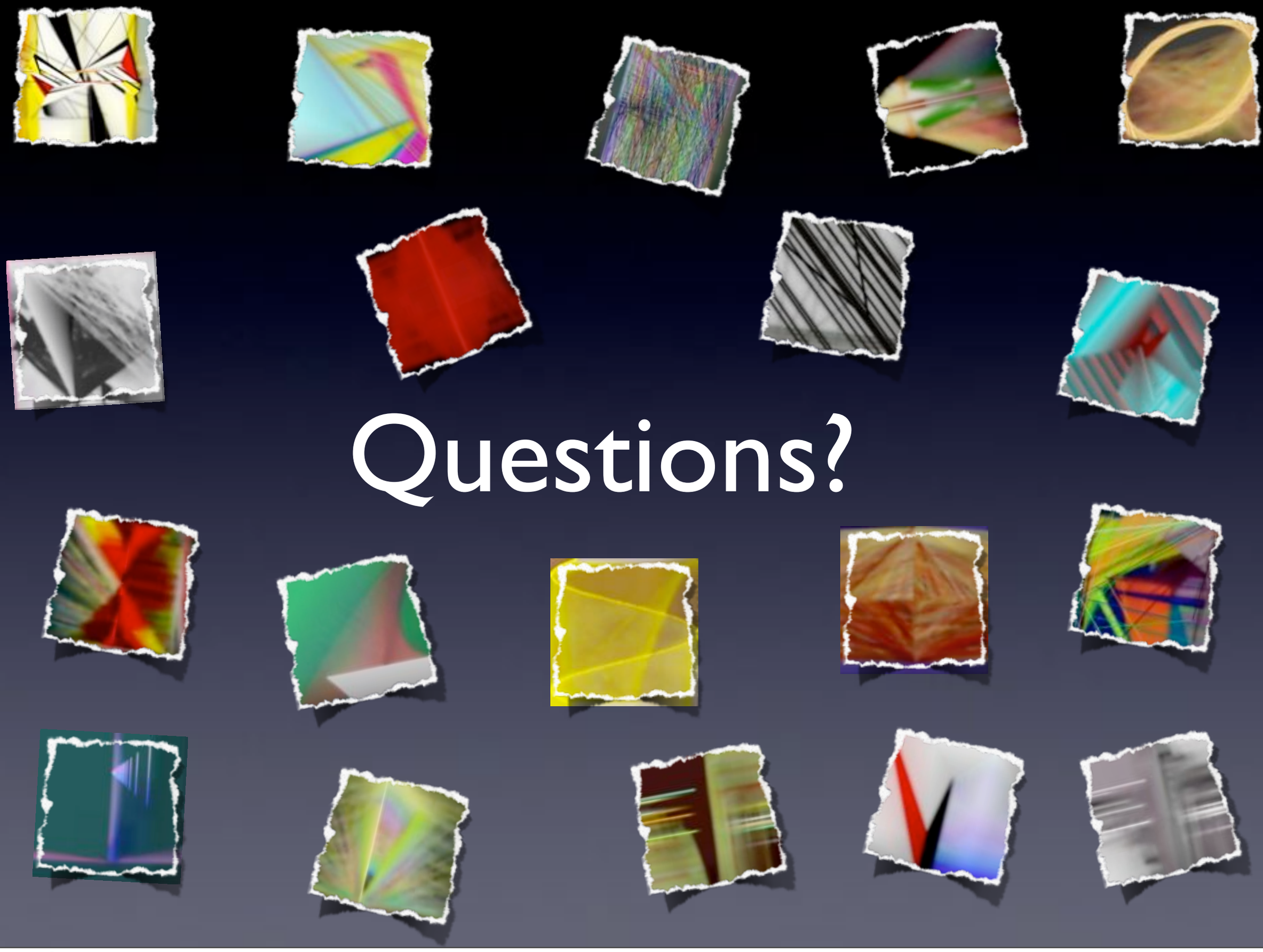
Bloomsbury Academic



Springer

Launch on Friday!!

ccg.doc.ic.ac.uk www.thepaintingfool.com www.gamesbyangelina.org



Questions?