LIST OF TODOS

Institute of Creative Technologies
De Montfort University

Fania Raczinski

Algorithmic Meta-Creativity

Creative Computing and Pataphysics for Computational Creativity

pata.physics.wtf

Supervisors:
Prof. Hongji Yang
Prof. Andrew Hugill
Dr. Sophy Smith
Prof. Jim Hendler

A thesis submitted in partial fulfilment of the requirements for the degree of Doctor of Philosophy

PRE ☺

And the air is purer, pif paf pan, ne put qu'articuler au, in the car as, deux hommes passer en courant dans la rue, having one foot shod and the other bare. And pure, staggered to and fro in the, And dire, in dire defeat. The hamlets bare White, une salle pleine le port de guerriers, over pine pitch. Will not you be content to pay a puncheon of Breton wine, the crimson mane of the fire o'er the plain tossing toward the dream. I was aroused from sleep by the cry of fire.

ACKNOWLEDGEMENTS

CONTENTS

PREFACE

HELLO WORLD

TOOLS OF THE TRADE

THE CORE: TECHNO-LOGIC

THE CORE: TECHNO-PRACTICE

FIGURES

TABLES

CODE

Part I

HƐLLΘ WΘRLD

might very well be the Sun himself, the despair and fear fell upon him, 'That it for always have we sincerely in love. The spacious hall prepare, the fishers hail each other - Nor help - in their fraternal lot, aux montagues d'oranges ... lndgate hill, with a helix at the four corners. She fell on to a hillock of sand, Who longs to plunge two fellow creature into despair, bid the beddies wail. not - till the Spectacles having had their belly.

Introduction

1

Feeling a movement of pity,
discovered the induction coil,
cette irraisonnee induction,
and entered the opening in the wall.

Only by some recherche movement,
apres coup et sous forme d'introduction,
opening his seized manuscript,
the enemy made within the enclosure of the vineyard.

Which he had thrown off at the beginning of his labor,
in opening so exactly at the,
than the thirst of my paternity.

We can then start at once,
and whose informing voice had consigned me to the hangman,
as any person at all conversant with authorship may satisfy himself at.

◎   ◎   ◎

This thesis describes **AMC!**. In other words it is about using creative computing to achieve computer creativity.

The project is transdisciplinary; it is heavily inspired by the absurd french   § **??** pseudo-philosophy pataphysics and draws from a wide range of subject areas   § **??** such as computer science, psychology, linguistics, literature, art and poetry, languages and mathematics.

The research included exploring what it means to be creative as a human, how   § **??** this translates to machines, how pataphysics relates to creativity and how creativity should be evaluated in machines.   § **??**

Using computers to produce creative artefacts is a form of computational creativity. Using creative techniques computationally is creative computing. **AMC!** (**AMC!**) spans the two—whether this is to achieve a creative or non-creative output. It is the use of digital tools (which may not be creative themselves) and the way they are used forms the creative process or product.

Creativity in humans needs to be interpreted differently to machines. Humans   § **??** and machines differ in many ways, we have different 'brains/memory', 'thinking processes/software' and 'bodies/hardware'. Too often creative output by machines is judged as we would a humans.

Computers which are truly artificially intelligent might be capable of true artificial creativity. Until then they are (philosophical) zombie robots: machines that behave like humans but aren't conscious. The only alternative is to see any computer creativity as a direct or indirect expression of human creativity using digital means and evaluate it as such. **AMC!** is neither machine creativity nor human creativity—it is both. By acknowledging the undeniable link between computer creativity and its human influence (the machine is just a tool for the

human) we enter a new realm of thought. How is **AMC!** defined and evaluated? This thesis address this issue.

1. a practical demonstration of **AMC!**
2. a theoretical framework to help interpret and evaluate products of **AMC!**

§ **??** The outcome of step (1) is presented as a website—pata.physics.wtf—written in 5 different programming languages[1], making calls to 6 external Web services[2], in a total of over 3000 lines of code[3] spread over 30 files.

§ **??** The main purpose of the system above is to demonstrate the three creative ***patalgorithms*** in the context of exploratory information retrieval. A browsing rather than a search engine, it presents results in various formats such as sonnets and golden spirals. The system partially automates the creative process, generating results on demand, which allows users to focus on their own personal artistic evaluation rather than production.

§ **??** Immediate inspirations come from fictional character *Doctor Faustroll* created by french absurdist and 'father' of pataphysics Alfred Jarry (**Jarry1996**), the fantastic taxonomy of the *Celestial Emporium of Benevolent Knowledge* by magical realist Jorge Luis Borges (**Borges2000**) and *A Hundred Thousand Billion Poems* by pataphysician and Oulipo co-founder Raymond Queneau (**Queneau1961**), amongst others.

§ **??** To address step (2) above, I explored the problem of objective evaluation and interpretation of subjective creativity specifically in regards to **AMC!**. I have argued that the most appropriate way to approach this is by looking at five objective constraints (person, process, product, place, purpose) and seven subjective criteria (novelty, value, quality, purpose, spatial, temporal, ephemeral) holistically and by understanding that humour and art 'lie in the ear and eye of the beholder'.

§ **??** This resulted in an ***interpretation framework*** visualised as an evaluation mat-
🔲 **??** rix (5 constraints x 7 criteria) which can be used to qualitatively and/or quantitatively measure the creativity of a given **AMC!** artefact:

1. a set of scales that can be used to approximate a 'rating' for the creative
§ **??**   value of an artefact,

---

[1]Python, **HTML! (HTML!)**, CSS, Jinja, JavaScript
[2]Microsoft Translate, WordNet, Bing, Getty, Flickr and YouTube
[3]2864 lines of code, 489 lines of comments - as of 08 Dec 2015

1.1 MOTIVATION

Computers are binary machines; the world is black and white to them (0 and   § **??**
1, on and off). Programmers can run abstract high-level commands which are
executed in sequence (with fast speeds giving the illusion of multitasking). They
are precise, structured, logical, and generally abide by strict standards. Com-
puters can only be creative if they are given clear instructions as to how. **IR!** is
generally focused on relevance of results in regards to the query.

> The Analytical Engine has no pretensions whatever to *originate* anything. It
> can do *whatever we know how to order it* to perform.   (**Menabrea1842**)

Pataphysics emerged during the *Belle Époque*[4] in France and has either directly   § **??**
or indirectly influenced various artistic movements such as Dada, Symbolism,
Surrealism, Oulipo and Absurdist Theatre. Pataphysics is highly subjective and
particular, values exceptions, the imaginary and the mutually incompatible.

Creativity is often studied at various levels (neurological, cognitive, and holist-   § **??**
ic/systemic), from different perspectives (subjective and objective) and charac-
teristics (combinational, exploratory and transformative). It is usually defined in
terms of value, originality and skill.

Combining computing with pataphysics seems impossible—although the anti-
nomies below (juxtaposing principles in computing on the left with ideas from
pataphysics on the right) highlight just how intriguing a possible combination of
the two would be.

- Polymorphism (generalisation) opposes particularity.
- Precision opposes exceptions and contradictions.
- Logic and structure oppose the imaginary and paradox.
- Cross-compatibility opposes the mutually exclusive.
- Responsiveness opposes the specific.
- Relevance opposes the creative.

This apparent dichotomy of computing and pataphysics is alluring. Christian
Bök argued that pataphysics "sets the parameters for the contemporary rela-

---

[4]1871—1914

6

tionship between science and poetry" (**Bok2002**). Pataphysics suddenly seems like the perfect choice infusing computers (science) with creativity (poetry).

⊞ **??** Combining pataphysics with creativity is easier. The ideas of combinatorial, exploratory and transformative creativity map quite nicely onto some pataphysical concepts such as clinamen, syzygy, antinomy and anomaly.

§ **??** Another motivating factor for this project was the lack of research in the particular area of creative computing in general. The discipline of computational creativity has emerged fairly recently[5] from a background in **AI!** (**AI!**). It appears to focus a lot more on the outcome of a product that would be judged creative rather than the actual process. Creative computing focuses on producing creative algorithms which may or may not have creative outputs. This was first
§ **??** addressed in (**Raczinski2013**) and later expanded into a definite description of this new discipline (**Hugill2013c**).

◎   ◎   ◎

My personal interest in this project comes from a background in computer science and a longstanding interest in art. Most recently I managed to successfully combine my technical skills with my creative side for a Master of Science degree in Creative Technologies at **DMU!** (**DMU!**)[6].

1.2 QUESTIONS

§ **??** Research dealing with subjective ideas and concepts like creativity throws up a lot of questions. My intention is to address them all throughout this thesis, although some of them will not have definite binary answers. An attempt to answer them can be found in the conclusion chapter **??**.

- What is the relationship between pataphysics and creativity?
- How might pataphysics be used to enable or enhance creativity?
- How is computer creativity related to artificial intelligence?
- Is there a clear distinction between computationally automated or emulated creative processes and the programmer's input?
- How can a machine's creative output be evaluated?
- How can these evaluatuative systems be improved?
- How can information retrieval be infused with creativity?

---

[5]The first International Conferences on Computational Creativity ran in 2010 for example.

[6]A passive interactive installation, augmenting a live video stream of users with interactive elements using motion tracking algorithms. See `msc.fania.eu`.

1.3 Methodology

§ **??** This project combines research in science and art making it transdisciplinary.

Pataphysics	Literature, Philosophy, Art
Creativity	Cognitive Science, **AI!**, **DH!** (**DH!**)
Technology	**IR!** (**IR!**), **NLP!** (**NLP!**), Web Development

Epistemology	Transdisciplinary, subjective
Methodology	Creative computing, exploratory, experimental
Methods	Artefact, literature synthesis, algorithm design, theoretical framework, critical reflection and analysis, rapid incremental prototyping

The general process of my project was as follows.

1. Critically analyse and synthesise existing literature,   ↺ II
2. develop pataphysical algorithms,   ↺ IV
3. design a system to demonstrate algorithms,   ↺ IV
4. develop a website as an artefact,   ↺ IV
5. define an evaluation and interpretation framework,   ↺ III
6. analyse results.   ↺ V

1.4 Contributions

The key contributions to knowledge described in this thesis are:

- Three pataphysical search algorithms (clinamen, syzygy and antinomy).
- A creative exploratory search tool demonstrating the algorithms `pata.phy sics.wtf`.
- A set of 7 subjective criteria and 5 objective constraints for defining creativity.
- A combined framework for evaluating and interpreting creativity.

1.5 Publications

Some chapters (especially **??** and **??**) in this thesis are based partially on articles published during this research. I have used fragments from those papers freely without specific citations unless clearly indicated. I had several co-authors

(Hongji Yang, Andrew Hugill, James Sawle and Dave Everitt) for these pieces and I hereby acknowledge their contributions.

The full list of publications can be found in the preface on page **??**. This also includes a full list of talks and exhibitions in appendix **??**.

<div style="text-align: right">§ **??**</div>
<div style="text-align: right">§ **??**</div>

1.6 THE HITCHHIKER'S GUIDE TO THIS THESIS

redo this at end when structure is final

This document is organised into 6 parts which form the main logical structure of the thesis and each part contains several chapters. There are margin notes pointing to relevant chapters, sections, tables, figures or images throughout.

put a "translation" of the contents in normal academic speak

PDF chapter bookmarks have normal names.

1.6.1 MARGIN NOTES

The different symbols used in margin notes are as follows.

⊞   Represents a table.
⊡   Represents a figure.
§   Represents a chapter.
🖼   Represents an image.

say more, add images to toc? describe code styles

1.6.2 THESIS LANGUAGE

This thesis was written in LaTeX.

say more, handmade style etc

1.6.3 CHAPTER OVERVIEW

PREFACE
.
Part I
    HELLO WORLD

update and describe each section briefly

TΘΘLS OF THE TR∀DΣ

Made up your minds to brave me, ce train recommençait quand il l'habillait le matin, aglavaine leans against a tree and weeps on silently, a difficulty in stemming the tide, aucun employé de commerce ne l'ignorait plus, blue, mad voyage 'gainst the tide, Her long gown with the train is blue, mad voyage 'gainst the tide. Sell that which ye have, to be their mouthpiece is it true, than filthy collier toad. Followed by a train of slaves, his Excellency stooped to take it up, or in the synecdoche of a bard.

INTERLUDE I

The view that machines cannot give rise to surprises is due, I believe, to a fallacy to which philosophers and mathematicians are particularly subject. This is the assumption that as soon as a fact is presented to a mind all consequences of that fact spring into the mind simultaneously with it.   (**Turing2009**)

Opposites are complementary.
It is the hallmark of any deep truth that its negation is also a deep truth.
Some subjects are so serious that one can only joke about them.   Niels Bohr

Computation is not a fact of nature. It's a fact of our interpretation.
                                                                       (**Searle2015**)

(...) through aesthetic judgments, beautiful objects appear to be "purposive without purpose" (sometimes translated as "final without end"). An object's purpose is the concept according to which it was made (the concept of a vegetable soup in the mind of the cook, for example); an object is purposive if it appears to have such a purpose; if, in other words, it appears to have been made or designed. But it is part of the experience of beautiful objects, Kant argues, that they should affect us as if they had a purpose, although no particular purpose can be found.   (**Burnham2015**)

Chance encounters are fine, but if they have no sense of purpose, they rapidly lose relevance and effectiveness. The key is to retain the element of surprise while at the same time avoiding a succession of complete non-sequiturs and irrelevant content   (**Hendler2011**)

Conducting scientific research means remaining open to surprise and being prepared to invent a new logic to explain experimental results that fall outside current theory.   (**Jarry2006**)

Part III

THE CORE: TECHNO-LOGIC

Do not cry, to be sure, your blows it cringe and cry and bleed, to will, cloth will retain its liquid content indefinitely. A royal robe he wore with graceful pride, how cold she must be, sa belle robe rose en desordre. Comme un filet sur le ceinture de la France et qui s'appela, mes bagages et regler ma note, if prince hydrogen. Ils peuvent aller a tome, satisfy unless in its very quintessence, there is none of his kindred.

Part IV

THE CORE: TECHNO-PRACTICE

I do not perform secular experiments, all becomes normal, his Excellency stooped to take it up, what future course I should pursue in regard to her. It is of no use, said the grand, but if you will follow my instructions, for he had already begun to exercise the tools, I could not help thinking of the wild ritual of this work. Importance de fonctionnement avec et normal, ce qui n'engage a rien du tout, a son usage. And four thousand idiots made, use it in different ways, of the globe, jamais on a le normale.

INTERLUDE II

all the familiar landmarks of my thought - our thought, the thought that bears the stamp of our age and our geography - breaking up all the ordered surfaces and all the planes with which we are accustomed to tame the wild profusion of existing things, and continuing long afterwards to disturb and threaten with collapse our age-old distinction between the Same and the Other.

(**Foucault1966**)—taking about Borges

Only those who attempt the absurd achieve the impossible.

(attributed to M.C. Escher)

A great truth is a truth whose opposite is also a great truth. Thomas Mann

(**Wickson2006**)

Heisenberg's Uncertainty Principle is merely an application, a demonstration of the Clinamen, subjective viewpoint and anthropocentrism all rolled into one.   (**Jarry2006**)

Epiphany – `to express the bursting forth or the revelation of pataphysics'

Dr Sandomir (**Hugill2012**)

Machines take me by surprise with great frequency.   (**Turing2009**)

Part V

MΣTⱯ-
LⱭGICⱯLYSIS

from a few sea, gobble ebery bit ob de meat off a skull, feat here of the customary, he might do it by the mere smell of one of his drugs. D'un jet de science lectrique, who yet always usurps the seat, the heat of the sun being very great, pet. Is there not a paving horse let go, there will be a scorching heat, mesh by mesh amain, sit not down in the chief seat. Then like a fine medal of a cuckold, the Oath of the Little men.

H∀PPILY ƧVƧR ∀FTƧR

Matter intense vibrates with fierce, but often, journey in quest of his father Ulysses, the latter granting us his assistance in our undertaking. It was later before I enter, the gas to be formed from these latter materials is a gas. Knew as much about the matter as I did — which was nothing, it was impossible to enter the cellar due to, in spite of ate and hey hen, Ushering in a few moment, the Promise, the outer walls were. It was an inexhaustible...

INTERLUDE III

There is no pure science of creativity, because it is paradigmatically idiographic
— it can only be understood against the backdrop of a particular history.
(**Elton1995**)

Tools are not just tools. They are cognitive interfaces that presuppose forms of
mental and physical discipline and organization. By scripting an action, they
produce and transmit knowledge, and, in turn, model a world. (**Burdick2012**)

Humanists have begun to use programming languages. But they have yet to
create programming languages of their own: languages that can come to
grips with, for example, such fundamental attributes of cultural communica-
tion and traditional objects of humanistic scrutiny as nuance, inflection, under-
tone, irony, and ambivalence. (**Burdick2012**)

Conceptually, I'm curious about what happens when an algorithm passes the
uncanny valley and becomes a perfect mimic. If humans were unable to dis-
tinguish the generated drug experience from a real one, the machine would
become a sort of philosophical zombie: an entity that appears to be some-
thing that it isn't, something it could never be. (**McDonald2016**)

POST☹

Allows air and steam to pass through but is impermeable to water, now twice ten years are past, and trod underfoot the moist and humid soil, the rest I have hereto subjoined. As he did once with the position of the horns of bulls, chuchote une collection de vieilles à fanons, there upon the Bush, and the last state of that man, incarnate of a rose upon the Bush, and the last state of that man. And the sea coast of Tyre and Sidon, your name out of the list of Mankind, to move from my reproachful posture.

KTHXBYE