talk about motivations for using certain things a certain way. I used french text in faustroll because i thought it would be fun.

reflect any changes here to the introduction section...

This project combines research in science, art and the humanities—making it transdisciplinary.

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

Traditional methodologies in these disciplines are very subject specific and a project combining elements of each field is left mixing and matching suitable methods from them all.

In this chapter I will outline the reasons why none of the existing methodologies are suitable for this project and then explain the choice of more transdisciplinary methods and how I combined them to suit my needs.

go over intro again when rest is written

§ **??** As mentioned in the **??** the overall objectives of this project are to create:

1. three pataphysical search algorithms,
2. a creative exploratory search tool incorporating the algorithms,
3. a set of subjective parameters for defining creativity,
4. an objective framework for evaluating creativity.

Research methods that support these tasks are needed and I will address these
§ 0.3 four points again at the end of this chapter.

0.1 Intradisciplinary

Different disciplines prefer different research methodologies. Of the various disciplines that inform this research the specific subareas that are relevant are as follows.

- Information Retrieval
- Interface Design

- Web Development
- Poetry, Literature, and Art
- Philosophy
- Human and Machine Creativity
- Creative Computing
- Computational Creativity

0.1.1 Technology

Half of this project's objectives are related to computer science therefore it is important to consider how research in this discipline is traditionally approached.

A framework for finding a suitable approach was suggested by Holz et al (**Holz2006**). The following four steps form an iterative process. "What do we want to achieve?" e.g. find out what is happening, develop something that works, evaluate an existing system/technology, compare existing systems, change human behaviour. "Where does the data come from?" e.g. how to collect? (read, observe, ask, measure, experiment, model) and where to collect? (field, laboratory, conceptual). "What do we do with the data?", e.g. identify themes/patterns/quotes, calculate numbers, identify trends, express via multimedia, create frameworks/taxonomies. "Have we achieved our goal?" e.g. draw conclusions, evaluate results, identify limitations.

Another option is to look at what computer science researchers have done historically. In a rather old but still insightful analysis of over 600 papers[1] Ramesh et al (**Ramesh2004**) have shown that—by far—the most common approach to research in computer science during this period was ***formulative*** with almost 79% use (as opposed to "descriptive" with 10% and "evaluative" with 11%) in particular in regards to "processes, methods and algorithms" which was used by just over 50% of researchers. Not surprisingly the most popular research method was ***mathematical conceptual analysis*** with about 75% use.

Jose Nelson Amaral (**Amaral**) classifies methodologies in computer science into five main categories as shown below.

Formal	Proof, verification, correctness
Experimental	Testing, evaluation, question answering
Build	Proof of concept, prototype, artefact
Process	Understand and define processes

[1]While the paper itself was published in 2004, the body of work they studied was based on publications from between 1995 and 1999—this suggests that a lot of the more "recent" research around Web technologies is not included in this study.

Model Abstraction, simulations

Based on (**Holz2006**), here are this projects answers to the four questions posed in the research.

What do we want to achieve?
- Understand human creativity and how this translates to machines.
- Understand the relationship of pataphysics and creativity.
- Understand how creativity is evaluated in humans and machines.
- Research suitable pataphysical concepts to be implemented as algorithms.
- Define algorithms formally.
- Implement prototype incorporating algorithms.
- Develop framework for interpreting and evaluating machine creativity.

Where does the data come from?
- Read pataphysical literature and research.
- Collate existing research on creativity and evaluation.
- Survey creative approaches to technology.
- Experimentation with algorithms and implementation.

What do we do with the data?
- Iterate through developmental stages of algorithmic outputs.
- Create an artefact that represents the underlying philosophy and research as a whole.
- Create evaluation framework based on theoretical research.

Have we achieved our goal?
§ **??** - See conclusion chapter **??**.

Referring back to the objectives above (see page 1), objective 1 is to create new creative search algorithms. This is not supposed to happen on a purely abstract basis but in a practical fashion ('experimental'), with a working implementation ('build') as proof of concept (see objective 2). While the algorithms need to be defined in formal terms ('formal'), the goal here is not to create a theoretical proof of correctness (given the creative and rather subjective nature of the underlying philosophy this is virtually impossible) but a practical demonstration of the creative processes behind. Given the creative nature of the algorithms, rigorous testing would be irrelevant. Overall this would suggest an experimental approach with prototyping of an artefact. Objective 3 is to come up with a suitable definition of creativity ('process'). This should be informed by existing research. Again, we are not interested in formulating this in mathematical terms and proofs but rather a more esoteric and systemic view. Because the definition needs to apply to humans and machines it needs to be precise enough. Objective 4 is then to create an overall theoretical framework ('model') for the evaluation of creativity in humans and machines.

By now we have managed to cover every one of the major methodologies mentioned in (**Amaral**) but we are still lacking ways to address the subjective and creative nature of the project. Furthermore, the philosophical and artistic inspirations that inform the development of the artefact don't get enough of a voice in these methods. In computer science, implementations are generally seen as a proof of concepts or prototypes—when really they should be seen as artefacts in the sense of artistic pieces of work. So, to really appreciate the scope of this practical element of this project we need to consider research in the arts and humanities too.

0.1.2 Arts and Humanities

> A hallmark of humanistic study is that research is approached differently than in the natural and social sciences, where data and hard evidence are required to draw conclusions. Because the human experience cannot be adequately captured by facts and figures alone, humanities research employs methods that are historical, interpretive and analytical in nature. (**Standford2016**)

Malins and Gray suggest the following ideas for arts-based researchers searching for the right methodology (**Malins1995**).

- Consider a range of research strategies (from all disciplines)
- 'Tailor' the research project to the nature of project and the researcher's expertise
- Carry out the research from the informed perspective of the reflective practitioner, as 'participant observer'
- Continually define and refine the research question, allowing methodologies to emerge
- Acknowledge accessibility, discipline, rigour, transparency, transferability
- Be aware of the critical context of practice and research and raise the level of critical debate
- Consider interdisciplinary / multidisciplinary approaches to research

They further elaborate on the key characteristics of arts methodologies as follows (**Gray2004**).

- Experiencing/exploring, gathering, documenting information and generating data/evidence
- Reflecting on and evaluating information, selecting the most relevant information
- Analysing, interpreting and making sense of information
- Synthesizing and communicating research findings, planning new research

(**Gray2004**)

They specify a whole set of individual methods used for the approaches above.

- observation and related notation/use of symbols
- visualization
- drawing (in all forms)
- diagrams
- concept mapping, mind mapping
- brainstorming/lateral thinking
- sketchbook/notebook
- photography, video, audio
- 3D models/maquettes
- experimentation with materials and processes
- modelling/simulations
- multimedia/hypermedia applications
- digital databases, visual and textual glossaries and archives
- reflection-in-action/'stream of consciousness'/personal narrative
- visual diary/reflective journal/research diary
- collaboration/participation/feedback, for example workshops
- use of metaphor and analogy
- organizational and analytical matrices
- decision-making flow charts
- story boards, visual narratives
- curation
- critical writing, publications
- exposition and peer feedback/review

(**Gray2004**)

§ **??** The discpiline of **DH!** (see chapter **??**) seems like a logical choice to look for suitable methodologies. It is characterised by "collaboration, transdisciplinarity and an engagement with computing" (**Burdick2012**) but it should not simply be reduced to 'doing the humanities digitally' (**Burdick2012**). Transliteracy, an understanding of several kinds of tools and media, is an important aspect in this (**Thomas2007**). **DH!** can be broken down into the following set of methodologies.

Design
: shape, scheme, inform, experience, position, narrate, interpret, remap/reframe, reveal, deconstruct, reconstruct, situate, critique

Curation, analysis, editing, modelling
: digitise, classify, describe, metadata, organise, navigate

Computation, processing
: disambiguate, encode, structure, procedure, index, automate, sort, search, calculate, match

Networks, infrastructure
: cultural, institutional, technical, compatible, interoperable, flexible, mutable, extensible

Versioning, prototyping, failures
: iterate, experiment, take-risks, redefine, beta-test

§ **??** Some of the emerging methods Burdick et al. have identified are listed below (**Burdick2012**) (The full list can be found in appendix **??**).

- structured mark-up
- natural language processing
- mutability
- digital cultural record
- algorithmic analysis
- distant/close, macro/micro, surface/depth
- parametrics
- cultural mash-ups
- algorithm design
- data visualization
- modelling knowledge
- ambient data
- collaborative authorship
- interdisciplinary teams
- use as performance
- narrative structures
- code as text
- software in a cultural context
- repurposable content and remix culture
- participatory Web
- read/write/rewrite
- meta-medium
- polymorphous browsing

Applying the above methodologies from the arts and **DH!** to my research is useful. Several of the overall methodologies listed by Gray and Malins (**Gray2004**)

Go to TOC

seem to apply to the research presented in this thesis. Exploring, evaluating, analysing, interpreting, synthesising and disseminating research all are part of it. However, looking at the specific methods they collated the difference becomes clearer as only the following 7 apply remotely (Visualization, experimentation with processes, multimedia/hypermedia applications, use of metaphor and analogy, organizational and analytical matrices, curation, and critical writing, publications).

The **DH!** methodologies seem more useful. In terms of ‘design’, `pata.physics.wtf` positions itself in context and the evaluation framework interprets and critiques **AMC!** (**AMC!**). Before that I ‘curate’ the two corpora, digitise them and organise them. ‘Computing’ comes in at verious stages, to (dis)ambiguate (i.e. pataphysicalise), encode, index, search and match data. The ‘infrastructure’ is cultural, technical and extensible, relying on the **WWW!** (**WWW!**) for several spects. ‘Versioning, prototyping and failures’ all come in during the iterative development process, which involves a lot of experimentation and refactoring. Furthermore, the methods Burdick et al (**Burdick2012**) list match this project much better.

0.2 Transdisciplinary

Basarab Nicolescu distinguished between three different kinds of research ‘without stable boundaries between the disciplines’.[2] (**Nicolescu2010**).

Multidisciplinarity
: concerns itself with studying a research topic in not just one discipline but in several simultaneously.

Interdisciplinarity
: concerns the transfer of methods from one discipline to another.

Transdisciplinarity
: concerns that which is at once between the disciplines, across the different disciplines, and beyond all disciplines.

The standard epistemological view of science and art is that they are objective and subjective, respectively. So, what does that mean for research conducted between, across and beyond science and art, i.e. research that is transdisciplinary?

Nicolescu criticises the view that science must be objective. He even claims that any non-scientific knowledge is “cast into the inferno of subjectivity, tolerated at

[2]Nicolescu cites Jean Piaget here, who first coined the term ‘transdisciplinarity’ in 1972.

most as a meaningless embellishment or rejected with contempt as a fantasy, an illusion, a regression, or a product of the imagination" (**Nicolescu2010**). Objectivity, he says, becomes the 'supreme criterion of Truth'[3]

> The death of the Subject is the price we pay for objective knowledge.
> (**Nicolescu2010**)

He goes on to quote Werner Heisenberg on the concepts of objective and subjective reality: "we would make a very crude simplification if we want to divide the world in[to] one objective reality and one subjective reality. Many rigidities of the philosophy of the last centuries are born by this black and white view of the world" (**Nicolescu2010**).

> The too strong insistence on the difference between scientific knowledge and artistic knowledge comes from the wrong idea that concepts describe perfectly the 'real things'. (...) All true philosophy is situated on the threshold between science and poetry. (**Nicolescu2010**)
> [4]

In transdisciplinarity traditional disciplinary boundaries have no meaning.

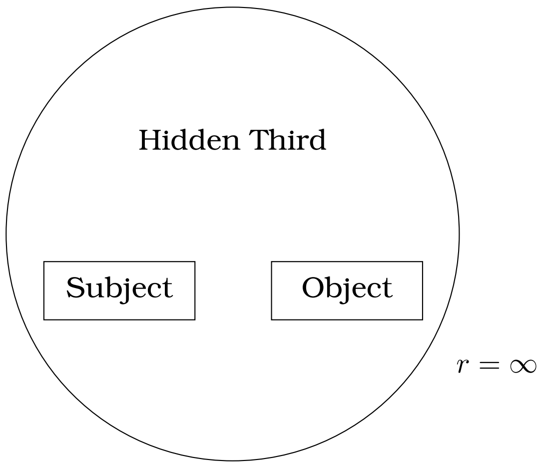

Figure 0.1 – Nicolescu's Transdisciplinarity

Working across disciplines requires a new unique methodology. Nicolescu pro-
poses a methodology of transdisciplinarity as a non-hierarchical ternary par-
0.1 tition of 'Subject, Object and Hidden Third' rather than the traditional binary
partition of 'Subject versus Object' (**Nicolescu2010**).

[3] As we shall see later, pataphysics does the opposite: it reveres the Subject.
[4] The full paragraph is worth quoting—see appendix **??**.

> The old principle "unity in diversity and diversity from unity" is embodied in transdisciplinarity.' (**Nicolescu2010**)

This project positions itself "at once between the disciplines, across the different disciplines, and beyond all disciplines"—making it transdisciplinary. The abolishment of disciplinary boundaries suits the unique context of this research. Pataphysics specifically is highly subjective. John Searle highlighted that ontologically subjective topics (such as creativity) can be studied in epistemically objective ways (**Searle2015**).

0.2.1 Hugill and Yang Methodology

> 'unite and conquer' vs 'divide and conquer' (**Yang2013**)

rephrase

Hugill and Yang suggest that existing research methodologies are unsuitable for transdisciplinary subjects such as **CC!** (**CC!**). The following is an example of a possible **CC!** research methodology they propose as a starting point (**Hugill2013c**):

1. Review literature across disciplines
2. Identify key creative activities
3. Analyse the processes of creation
4. Propose approaches to support these activities and processes
5. Design and implement software following this approach
6. Experiment with the resulting system and propose framework

They go on to propose four standards for **CC!** (**Hugill2013c**) namely, resist standardisation, perpetual novelty, continuous user interaction and combinational, exploratory and or transformational.

0.2.2 Practice Based

Linda Candy defines practice based research as follows.

> Practice-based Research is an original investigation undertaken in order to gain new knowledge partly by means of practice and the outcomes of that practice. (**Candy2006**)

Go to TOC

She further explains that original contributions to knowledge required in PhD projects can be demonstrated through creative outcomes 'in the form of designs, music, digital media, performances and exhibitions' (**Candy2006**).

finish section on practice based research here

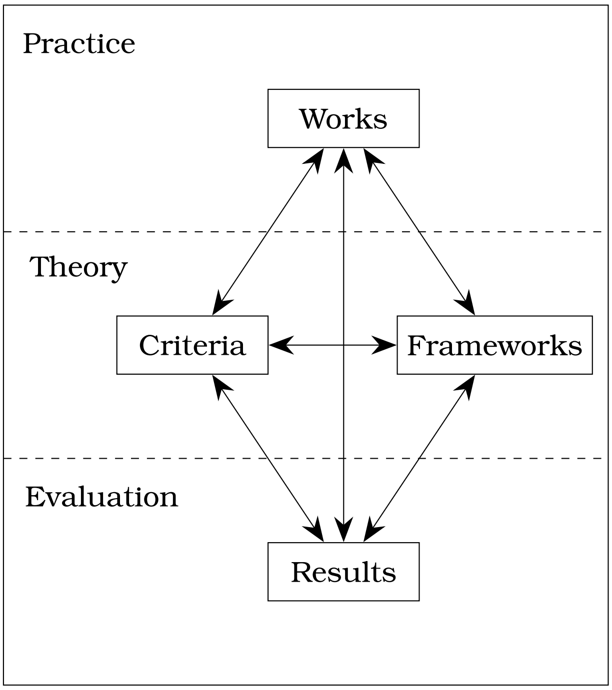

Figure 0.2 – Edmonds and Candy's Trajectory Model

0.2 Figure 0.2 shows the **TMPR!** (**TMPR!**) developed by Ernest Edmonds and Linda Candy as a framework to 'influence practice, inform theory and, in particular, shape evaluation' (**Edmonds2010**). The model allows for different trajectories
0.1 between practice, theory and evaluation. Table 0.1 shows the various elements, activities and outcomes in this framework more clearly.

0.3 My Research Approach

rapid incremental prototyping

The doctoral research presented in this thesis does not fit into neat categories in science or art—making it transdisciplinary in nature. Subjects like literature, philosophy, cognitive science, artificial intelligence, software engineering and linguistics frame the three core areas of research for this project, namely pataphysics, creativity and computing.

To address the transdisciplinary nature of the project I

Table 0.1 – Elements, Activities and Outcomes of each Trajectory in the **TMPR!**

Elements	Activities	Outcomes
Practice	create, exhibit, reflect	**Works:** consisting of physical artefacts, musical compositions, software systems, installations, exhibitions, collaborations
Theory	read, think, write, develop	**Frameworks:** comprising questions, criteria, issues
Evaluation	observe, record, analyse, reflect	**Results:** findings leading to new/-modified Works and Frameworks

employed a practice-based research methodology, meaning that part of my submission for the degree of Doctor of Philosophy is an artefact demonstrating my original contribution to knowledge. The thesis provides the context of this artefact and critically analyses and discusses the experimental process and outcome.

Epistemology
: Transdisciplinary, Subjective

Methodology
: Qualitative, Exploratory

Methods
: Creative Computing, Website Development, Literature Review, Evaluation Framework, Critical Reflection

The general workflow of my project was as follows.

relates back to hugill and yang approach

1. Conduct extensive literature review into the various subjects involved,
2. develop pataphysical algorithms,
3. develop an evaluation framework,
4. design a system to demonstrate algorithms,
5. develop a website for the tool,
6. evaluate website using framework and redevelop as needed and
7. write up findings.

Go to TOC

0.2 In regards to the practice based methodology, I followed the following trajectory inspired by the **TMPR!**.

create my own tmpr figure here

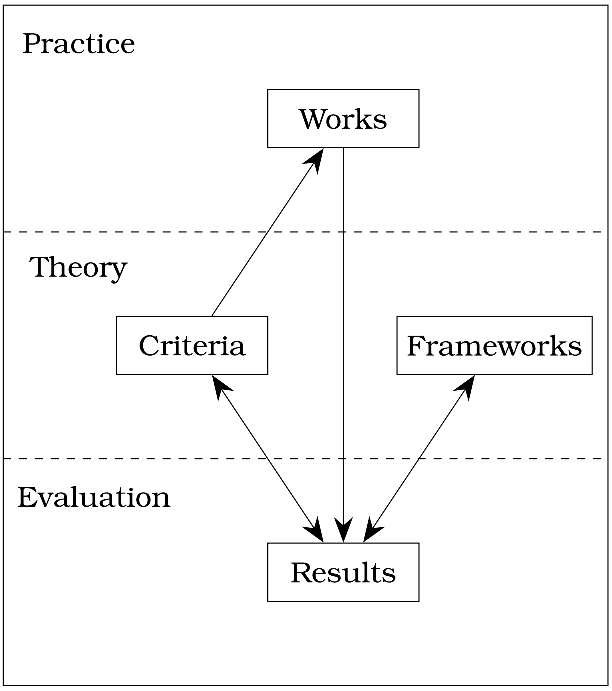

Figure 0.3 – Fania's Trajectory Model

Practice
(Works): Implementation of Algorithms, Development of Website

Theory
(Criteria, Frameworks): Creation of Algorithms, Setting Context, Define Evaluation Framework

Evaluation
(Results): Interpretation of Work

This tmpr is my thesis.
works: pata.physics.wtf
criteria: criteria for creativity
frameworks: evaluation framework
results: conclusion

does the tpmr fit into the hugill and yang approach?

§ **??** The general process of my project was as follows.

1. Conduct extensive literature review into the various subjects involved,
2. develop pataphysical algorithms,
3. develop an evaluation framework,
4. design a system to demonstrate algorithms,
5. develop a website for the tool,
6. evaluate website using framework and redevelop as needed and
7. write up findings.

comp creat vs creat comp

list out the different examples of why my project is both of the above. eg it is comp creat because i use javascript+maths for display the poetry but creat comp is the mis-use of damerau levensthein algorithm