

## 0. Introduction

---

If we want to know whether someone is suffering from a mental disorder, we send them to a psychiatrist. We do so apparently because we believe that psychiatrists enjoy epistemic superiority when it comes to diagnosing mental disorders, relative to non-experts in the field of psychiatry. Although it is *prima facie* plausible to assume that psychiatrists have a better capacity for diagnostic judgement than individuals untrained in the field of psychiatry, this assumption itself raises questions. One of these questions, the one I will be concerned with in this part of the thesis, is: how do psychiatrists arrive at their diagnostic conclusions?

This question is of importance to philosophy of psychiatry and should also be of interest to clinicians themselves. It deserves philosophical attention because answering it is a requirement for a systematic understanding of the epistemology of psychiatry, which consists not only of epistemic issues around the psychiatric sciences and the choice of medical interventions, but also of diagnostic decision-making. Moreover, developing an understanding of psychiatric diagnostics is a requirement for enabling us to discuss other phenomena of ethical and epistemological interest in psychiatry. These phenomena include the ethically important task of deciding when a diagnostic decision is just wrong and when it is malpractice, and how to understand the social-epistemological dynamics involved in resolving expert disagreements regarding diagnosis. Addressing these and other topics are desiderata for a theory of psychiatric diagnostics that can be addressed in meaningful depth only on the foundation of an established understanding of the diagnostic process itself. The three major aims of this thesis are: (1) to provide a new proposal for how psychiatrists arrive at their diagnostic judgements, (2) demonstrate how this proposal enables us to address several desiderata of a philosophical account to psychiatric diagnostics, and (3) to defend this approach against existing alternative approaches is the aim of this book.

Before the real work begins, I will use this Introduction to set the scene. I will (O.1) reformulate and clarify the causal question “How do psychiatrists arrive at their diagnostic conclusions?” to prepare it for a philosophical treatment. After that I will (O.2) foreshadow the answer to the Methodological Question that I will develop and

answer in this thesis. Finally, (0.3) I will lay out the chapter structure of the thesis and (0.4) make the transition to Chapter 1.

## 0.1 The Methodological Question

In order to develop a philosophical account that can answer the question “how do psychiatrists arrive at their diagnostic conclusions?”, we need to do some preparatory work on the question itself. This preparation will clarify how I think the question should be understood for the purpose of a philosophical investigation and thus what to expect from an adequate answer to it. Doing so will avoid misunderstandings regarding my project. First, therefore, let me concretise how I understand the question.

I will take the question of how psychiatrists arrive at their diagnostic judgements to be a question about the *method* used by psychiatrists to make their diagnostic judgements. Why a method? According to Goldman (2000), learned belief-forming procedures shape our inquiry. To think of diagnostics carried out by psychiatrists as following a learned belief-forming procedure to arrive at their diagnostic conclusions seems *prima facie* plausible given that psychiatrists are medical experts who receive scientific and clinical education acquiring knowledge and skill for their clinical work, including diagnostics. Plausibly, they are not born with diagnostic insight; they learn what to do to generate it. If we consider psychiatric diagnostics to be a method, asking how it works is about asking questions of methodology. Thus, I will call the question I work towards answering in this book the Methodological Question. “What is the method of psychiatric diagnostics?” Next, let me lay out what will be required in order to answer the Methodological Question – that is, in order to propose a clinical methodology of psychiatric diagnostics.

Providing an answer to the Methodological Question has adequacy conditions and desiderata. The adequacy conditions are the minimal requirements a proposed answer should meet to provide a proper answer to the Methodological Question. The desiderata are things we want from the adequate answer to the Methodological Question to make it an actually good answer; they are factors that, if a given answer offers more of them than another, might make this answer preferable to others. I will discuss both aspects in turn.

The adequacy conditions for an answer to the Methodological Question derive from the question's format. Because we are asking about the methods of diagnostic reasoning, it is a Methodological Question. And, again according to Goldman (2000), methodologies are theories of methods that, as such, describe, explain, and evaluate methods of inquiry. To address the Methodological Question, given Goldman's characterisation, and to provide a theory of the method of psychiatric diagnostic reasoning, we need to do three things:

1. We need to adequately describe the method at work behind the diagnostic process. What does this method look like? How does it operate? When are its constituent steps carried out?
2. We need to explain the rationale behind the method. What purpose do the steps in the method serve? How are these steps thought to contribute to the achievement of the epistemic end of the method used?
3. We need to lay out what to think of the justificatory status of beliefs achieved using this method. How are specific aspects of the method thought to justify its outcomes? Can we say something general about how promising the method is for arriving at true conclusions, or at least set out how we may make such judgments for specific instances of the methods used?

Beyond these general adequacy conditions that provide the minimal requirements for an answer to the Methodological Question, there are some intuitive desiderata for an answer. While the adequacy conditions stated in the last paragraph derive purely from the Methodological Question requiring a methodological proposal, additional desiderata derive from its target: psychiatric diagnostics. If the proposal wants to do more than meet some minimal criteria – that is, if it aspires to explore some aspects of psychiatric diagnostics in reasonable depth – these desiderata should be met. In what follows, I offer a list of plausible desiderata, some of which were already mentioned when motivating the Methodological Question.

1. An answer to the Methodological Question should allow us to make sense of the relevant steps of the diagnostic process. A proposal should not leave major aspects poorly understood, lacking a rationale for their existence in the process. Only then can we say that the proposal really encompasses psychiatric diagnostics.
2. An answer to the Methodological Question should provide a proposal that is cognitively realistic. By cognitively realistic I mean that the way the proposed method describes psychiatric diagnostics as the activity of psychiatric experts should account for the engagement of psychiatrist in that process in a way that not only is able in principle to make sense of the steps of the diagnostic process (as required in my last point) but does so in a way that appears to be attainable and realistically undertaken by psychiatrists as cognitive agents, if only under ideal circumstances (e.g., no time pressure). The desired proposal does not require psychiatrists to think or act in a way that goes obviously beyond an expert human capacity; rather, it seems to be a plausible intentional cognitive and behavioral procedure carried out by clinicians. This will prevent the answer from being more than a proposal for understanding diagnostics that works in the armchair but bears minimal relation to real practice.

3. The answer to the Methodological Question should allow us to explicate the internal standards embodied in actual diagnostic practices, enabling us to say when failure counts as malpractice or just a wrong diagnosis.<sup>1</sup> The capacity to make such crucial distinctions regarding the outcomes of diagnostic process matters in part because it concerns central legal and ethical issues in diagnostics, but also because it denotes an appropriately deep understanding of diagnostic standards.
4. An answer to the Methodological Question should be able to explain the occurrence and resolution of diagnostic uncertainty, for example as regards whether or not one should attribute a specific symptom or diagnose a specific disorder in a patient. Accounting for uncertainty and its resolution is an obviously relevant requirement given the frequent day-to-day occurrence of this phenomenon in diagnostic clinical work.
5. An answer to the Methodological Question should make sense of the phenomenon of the sometimes-observed good diagnostic “instincts” of experienced clinicians who rapidly come up with potential diagnostic conclusions and often turn out to be right. The answer to the Methodological Question should enable us to understand how these “instincts” work, and how to assess their conclusions in relation to the internal standards of psychiatric diagnostics. Again, being able to explain and evaluate this phenomenon is relevant given its apparent prevalence in clinical practice and the resulting question of whether or not it is permissible to make instinctive diagnoses.
6. An answer to the Methodological Question should be able to help us understand the occurrence of diagnostic disagreements amongst individual clinicians, as well as amongst the same clinician's judgements over time. Again, this matters because such disagreements are part of everyday clinical reality; being unable to

---

1 What do I mean by “internal standards”? Internal standards are epistemic norms that psychiatrists ought to follow to arrive at permissible diagnostic conclusions. Conclusions will be considered permissible because they are considered justified by the standards of the expert clinical community that espouses this standard. Although the justification established in this way does not in itself guarantee the desirability of the diagnostic judgements as a function of any “objective” well-groundedness or reliability (this would require further argument), it is nonetheless relevant to matters of responsibility and culpability. Consider the case where a psychiatrist's diagnosis is wrong, but she works in accordance with the internal standards. She will not be considered culpable, as she was justified in making this diagnosis. If, on the other hand, a psychiatrist guesses a diagnosis and thereby violates the internal standards of psychiatric diagnostics, he will be judged culpable of diagnostic malpractice. To make sense of this, both internal standards and the corresponding understanding of justification are relevant. For a similar take on justification, see Pollock (1986, p. 125); Carter and Littlejohn (2021, pp. 320–322.).

address a common phenomenon in diagnostic practice would render an answer of little explanatory use.

7. Finally, it would be desirable that an answer to the Methodological Question could help us understand how changes and hopefully improvements in our understanding of psychopathological conditions are integrated into existing diagnostic practice, or might lead to changes in the framework of psychiatric diagnostics itself. This capacity would make an answer a useful tool for thinking about the (near) future of psychiatric diagnostics.

I have now presented a proposal regarding the Methodological Question and a statement as to what will be required to answer it productively. However, something about the Methodological Question is still vague.

Speaking of a method of psychiatric diagnostics *per se* seems problematic. “Psychiatric diagnostics” considered broadly is an ambiguous term because psychiatric diagnostics is a heterogeneous epistemic practice. Looking at it from a historical perspective, or systematically within any given period of its history, would reveal many methods that physicians concerned with mental disorders have used to diagnose their patients. Accordingly, to provide a presentation of “psychiatric diagnostics” as referring to “everything that every psychiatrist ever did to find out about their patients’ psychopathological status” would be an encyclopaedic task. Not only is such a task beyond the scope of what I can do in this project; moreover, it stands to reason that given the heterogeneity of psychiatric diagnostic approaches, considering diagnostics so broadly would doom to failure any attempt to identify a single common method behind all these different ways to diagnose. To avoid this problem, I will limit the scope of my analysis of psychiatric diagnostics – and accordingly of the underlying diagnostic reasoning – to a sufficiently homogenous set of practices to offer a manageable explanandum as a target for the Methodological Question.

For the purpose of answering the Methodological Question, I will consider psychiatric diagnostics to consist of diagnostic efforts carried out by trained professionals through their cognitive and behavioural efforts to arrive at diagnostic conclusions. This process is usually called *clinical diagnostic reasoning*. But I will be even more specific, because this first limitation is still too broad. The diagnostic reasoning of clinicians may vary significantly, and to treat “diagnostic reasoning” as co-extensive with “everything that any psychiatrist ever did to arrive at the diagnostic proposal” is not a promising basis for arriving at a common method and methodology. Hence the kind of diagnostic reasoning I will focus on will be what I understand to be at the heart of (1) *contemporary* and (2) *proper* diagnostic reasoning practice. The question then, of course, is how I determine what I will regard as instances of such contemporary and proper psychiatric diagnostic reasoning.

To gain insight into what constitutes proper contemporary diagnostic reasoning procedures will involve looking at recent authoritative sources on psychiatric diag-

nostics. I will take into consideration recent position papers and practice guidelines from relevant expert communities such as the *American Psychiatric Association*, as well as recent editions of autorotative textbooks for psychiatric training such as *Kaplan and Sadock's Synopsis of Psychiatry* (Sadock and Sadock, 2014). Setting this focus ensures that my answer to the Methodological Question addresses what is widely accepted as a proper and contemporary approach to psychiatric diagnostic reasoning within the psychiatric expert community itself, and thus that my answer will be of interest to a wide audience. More anachronistic or obscure approaches to diagnostics that deviate from what is widely held to be the state of the art within psychiatry will therefore not be reflected in this work. In sum, the Methodological Question, if we spell out the version that I will work with, is: **what is the method of proper contemporary psychiatric diagnostic reasoning?**

Narrowing our focus to contemporary proper psychiatric diagnostic reasoning leads to a final point concerning the Methodological Question, namely whether it is a normative or a descriptive question and so whether my answer to the Methodological Question should accordingly be consider prescriptive (i.e., normative) or descriptive. The Methodological Question is not a clear-cut example of either a normative or a descriptive question; nor will an answer fall neatly into either of these categories. Rather, both the question and the answer will have to involve both description and normativity. They are descriptive because by inquiring into what the method at work in psychiatric diagnostics is, the question and its answer are concerned with an actual state of affairs that is targeted by the question and can be explained by its answer. The question and answer also have a normative side, since the exemplification of the method at work is supposed to exemplify, specifically, what the *proper contemporary* method is. As such, answering the question will result in a proposal that has the normative force of claiming that one must follow this method if one wants to practise psychiatric diagnostics in accordance with the currently widely shared standards of the clinical psychiatric community. This normativity, however, does not derive directly from any facts of the described method itself (it thus avoids the trap of deriving an *ought* from an *is*); rather, an answer to the Methodological Question gains normative character from the initial normative character of the descriptions of the diagnostic practice on which the proposal of the method is based. Specifically, normativity derives from guidelines and teaching literature intended to say how diagnostics *ought* to take place by establishing relevant standards.

Let me sum up my discussion of the Methodological Question. I plan to address the question of how psychiatrists arrive at their diagnostic conclusions, interpreting this inquiry as what I called the Methodological Question. Namely: What is the method of proper contemporary psychiatric diagnostic reasoning? To address this question adequately, I will present a methodology of psychiatric diagnostic reasoning, providing a description of the method being used, the rationale behind its procedures, and how its conclusions are deemed justified. The resulting methodological

proposal will, on the one hand, be descriptive regarding the method in place, but on the other hand, it will have some normative relevance because it is the description of a practice derived from sources that not only present the method but propose that this is the proper method one ought to follow in psychiatric diagnostics if one practises in accordance with the expert community's self-imposed standards for good diagnostic practice.

This proposal will have to meet several requirements. At a minimum, it will have to encompass the necessary aspects of a methodology: a description of the method that I claim to be enacted in psychiatric diagnostic reasoning; an explanation of the rationale behind the method's procedures; and an account of the justifications given to conclusions achieved by these procedures. Moreover, I will have to establish that the descriptive part of my methodological proposal is indeed embodied in diagnostic reasoning practices, to make the presented methodology plausibly apply to psychiatric diagnostics. Beyond this minimal requirement, there are seven desirable features that an answer to the Methodological Question should provide. First, to show a close match between individual aspects of the method and the diagnostic procedure, leaving no aspects of the diagnostic procedure unexplained. Second, to provide a cognitively realistic proposal. Third, to enable the differentiation between misdiagnosis and diagnostic malpractice. Fourth, to explain the occurrence and resolution of diagnostic uncertainty. Fifth, to understand and evaluate diagnostic "instincts". Sixth, to explain diagnostic disagreements and their resolution. And seventh, to enable discussion of the impact that progress in our understanding of psychopathology might have on psychiatric diagnostics.

Now that the Methodological Question is established, and I have discussed what an answer to this question should look like, I will proceed to offer an outline of my answer to it.

## 0.2 The Model-Based Account of Psychiatric Diagnostic Reasoning

The basic idea behind my answer to the Methodological Question is that diagnostic psychiatric reasoning can largely be understood as a modelling process that informs less complicated inferential follow-up processes. Therefore, I call my proposal the *model-based account of psychiatric diagnostic reasoning*. Modelling in this context does not mean modelling in the basic sense in that all cognition may be a form of modelling on some level of description, as a number of psychologists and philosophers have claimed (e.g., Johnson-Laird, 2010 Hohwy, 2013). What I have in mind is that on an explicit personal level, the reasoning and actions of psychiatrists in the context of diagnostics embodies the epistemic activity of modelling as we also see it at work in applied or pure sciences.

A proposal to understand psychiatric diagnostic as a form of modelling is overdue. As Mebius and colleagues have pointed out for philosophy of medicine, diagnostic reasoning as “related to model-based reasoning in science [...] is an underexplored area in philosophy of EBM [Evidenced Based Medicine]” (Mebius, Kennedy, and Howick, 2016, p. 760).<sup>2</sup> Although my proposal is more modest, in that it makes no claims about medical diagnostics in general, it at least addresses this issue for the medical subfield of psychiatry. Let me now provide a first rough first idea of what I will argue for.

According to the model-based account of psychiatric diagnostic reasoning, diagnostic reasoning is a multi-level inferential process: a modelling procedure carried out by psychiatrists based on their psychopathological, common-sense psychological, and medical background knowledge. The lowest but also most inference-heavy level of the process is a modelling procedure. On this level, psychiatrists consider the initial presentation of patients leading them to evaluate those patients in more depth for the presence of specific psychopathological symptoms. For this procedure, psychiatrists employ models of psychopathological conditions as well as alternative explanations for patients’ problems, and they compare these models to the patients’ reports, behaviours, and sometimes cognitive or biological testing. Selecting the best fit from amongst the sufficiently well-fitting of the available diagnostic models, the comparison allows them to infer the presence or absence of specific psychopathological symptoms in patients.

In a second step, the selection of models applicable to the patient – each one applicable to one of the different complaints of the patient and thus suggesting how an aspect of the patients’ presentation should be evaluated – is summed up in a bundle of selected models, each of them suggesting a psychopathological evaluation of one of the patient’s complaints, accompanied by information about the relevant evidence that led to their selection. This synthesis of diagnostic outcomes and supporting evidence is noted in the diagnostic case formulation, which also provides an interpersonal means for clinicians to discuss and assess diagnostic conclusions and reflect on their own diagnostic conclusions.

At the same time, in well-trained clinicians, a pattern-recognition process occurs based on the outcome of the diagnostic modelling procedure that enables clinicians to recognise the diagnosed patterns of symptoms, in accordance with the rules of a presupposed classification system like the DSM or ICD, as syndromal diagnosis takes place. The specific rules governing this process are thereby determined by the relevant diagnostic manual. What exactly this modelling process looks like, as well as

---

2 To my knowledge, this option is mentioned only in passing by Upshur and Colak (2003) in a general discussion of medical reasoning, and developed only briefly for psychiatric reasoning in Dominic Murphy’s *Psychiatry in the Scientific Image* (2006, pp. 205–209, 365–366).



how it is transformed into the summary case formulation and informs inferencing about the disorder diagnosis, will be developed in detail in the relevant chapters.

As the name of my proposal suggests, the bulk of my work will focus on the level of model-based symptom diagnostics. There are three reasons for this. First, this portion of the diagnostic process is the one where most of the heavy lifting is done in terms of information-gathering and inferential work. The higher levels of diagnostic reasoning – that is, providing the formulation and identifying the right disorder diagnosis based on the rules of a diagnostic manual – are comparatively less complex and will therefore take up less space in my inquiry. Second, the focus on the modelling portion seems appropriate since this most basic level of diagnostics, which provides diagnostic conclusions about symptoms, is the foundation for all higher-order judgements about the presence of psychiatric syndromes. As such, diagnostic modelling will be the source process enabling both formats of diagnostic conclusions: those directly concerned with symptoms and also those indirectly concerned with disorders (i.e., with established conclusions about disorders based on present symptoms). Modelling is, in this sense, the foundational level of diagnostic reasoning. Third and finally, this focus is of interest since the aspect of psychiatric diagnostics that modelling will explain in my account, namely the diagnose of symptoms, has been long neglected in philosophy of psychiatry. The major debates that have raged over the last decade in science, philosophy, and the media since the launch of the DSM 5 have mostly been caught up in debates about disorders. A stronger focus on symptoms will offer a valuable corrective counterpoint to this bias.

Unsurprisingly, my proposed model-based account of psychiatric diagnostic reasoning is not the only game in town, so whatever proposal I make I will have to engage with the other proposals out there. This will be done in full in the final chapter of this thesis. However, to offer an outline of who will be part of the conversation, I will briefly introduce the work of authors who have defended their own positions in response to (aspects) of the Methodological Question, or who have at least been interpreted as aiming to do so.

The first philosopher whose work I will discuss, since it has been taken to contribute to the Methodological Question, is Cooper (2014). Her contribution focuses on case histories in the context of clinical diagnostic work, and more particularly on the role that “Einfühlung” or empathy in understanding one’s patient plays in such case histories and how it allows clinicians to provide explanations for patients’ clinical presentation. Secondly, we turn to Murphy (2006), who defends a theory of diagnostic reasoning based on the assumption that psychiatrists have fully fleshed-out scientific models of psychiatric disorders from which they derive a further idealised theoretical representation of this disorder and compare this representation of the disorder to the patient to make diagnostic inferences. Then there is Reznek (1998), who decades ago was already seriously engaging with the question of how exactly psychiatrists’ diagnostic judgements come about and are justified. Reznek

puts forward a proposal that considers psychiatric diagnostics to employ a certain pattern of inference: inference to the best explanation. Next up are Gupta, Potter, and Goyer (2019), who, rather than providing a full account of psychiatric diagnostic reasoning, defend the claim that the second-person perspective, and with it second-person knowledge about the patient that is acquired by empathising with them, is a necessary component of any psychiatric assessment of the presence of mental (i.e., not merely behavioural) symptoms of mental illness. They argue that this is an important enabler of diagnostic reasoning, often missed by existing accounts. Finally, I will consider researchers working within the phenomenological tradition, namely Fuchs (2010) and Parnas, Sass, and Zahavi (2013). They defend an account of psychiatric diagnostics inspired by gestalt psychology in which psychiatrists arrive at diagnostic conclusions by recognising the gestalt of the disorder in the patient's presentation and by this means infer the presence of this disorder.

In Chapter 5, I will argue that the *model-based account of psychiatric diagnostic reasoning* offers a preferable alternative. Now that my own proposal has been sketched out and the discourse about the Methodological Question that it will contribute to has been outlined, let me set out how I intend to structure the presentation of my argument.

### 0.3 Book Chapter Overview

In Chapter 1, I provide a descriptive account of the core aspects of proper, contemporary, psychiatric diagnostic reasoning and how they are functionally linked to each other in diagnostic practice. This will provide my inquiry with the idea of the diagnostic practice targeted by the Methodological Question and thus by any proposal aimed at answering it. To ensure that the description accurately covers what currently is considered to be proper diagnostic reasoning, this presentation will, as noted earlier, be based on psychiatric training literature as well as the diagnostic manuals and guidelines generated by expert organisations.

In Chapter 2, I introduce modelling in general, and more specifically the form of modelling that I will claim to be the method at work in psychiatric diagnostic reasoning, namely qualitative, constitutive diagnostic modelling. Moreover, I provide an analysis of the rationale behind this method of modelling, and suggestions as to how its conclusions are deemed justified. By addressing these issues, I am able to demonstrate that the method of diagnostic modelling presented in this chapter does indeed map onto psychiatric diagnostics, as well as putting in place the other elements required to provide a full answer to all three aspects of the Methodological Question. That is to say, I will have presented a description, a rationale, and a justificatory analysis for the method of modelling that I need to map onto psychiatric diagnostics.

In Chapter 3, I establish the mapping between the method of diagnostic modelling presented in Chapter 3 and the understanding of diagnostic reasoning laid out in Chapter 1. This mapping supports my proposal that psychiatric diagnostic reasoning should be understood as an instantiation of a specific kind of diagnostic modelling, and that its methodology can be understood along the lines also presented in this chapter. This establishes my initial argument for the plausibility of the *model-based account of psychiatric diagnostic reasoning*.

In Chapter 4, I show how my proposal is able to address the aforementioned desiderata for an answer to Methodological Question. Specifically, I demonstrate that my proposal shows a close match between particular aspects of the method and the diagnostic procedure, leaving no aspects of the diagnostic procedure unexplained; that it provides a cognitively realistic proposal; that it allows for differentiation between a working diagnosis and diagnostic malpractice; that it explains the occurrence and resolution of diagnostic uncertainty; that it allows us to understand and evaluate diagnostic “instincts”; that it explains diagnostic disagreements and their resolution; and finally, that it enables discussion of the impact that progress in psychopathology might have on psychiatric diagnostics.

Finally, in Chapter 5, I look more closely at the alternative proposals touched on earlier that are considered to provide answers to the Methodological Question, some taking similar angles to my approach. I present these accounts in more depth and, for each, indicate specific respects in which the *model-based account of psychiatric diagnostic reasoning* can be considered an improvement on it. The improvement may derive from the fact that an alternative does not actually address diagnostic reasoning (Cooper), makes some implausible moves or is highly abstract (Reznek, Murphy), or relies on claims about parts or the whole of psychiatric diagnostic reasoning that can be shown to be implausible (Gupta, Potter, and Goyer; Fuchs; Parnas, Sass, and Zahavi).

I close my inquiry in the concluding Chapter 6 with a brief review of my argument. I ask whether my research has established an answer to the diagnostic question that meets the criteria set out in this Introduction and whether it offers an attractive alternative to existing views on the details or the entirety of psychiatric diagnostic reasoning.

## 0.4 Conclusion

In this Introduction I have introduced, motivated, and explained the research question of my investigation. The Methodological Question can be formulated as follows: “What is the method of proper, contemporary, psychiatric diagnostic reasoning?” I have briefly presented the answer to the Methodological Question that I will develop and defend throughout this thesis, as well as offered an outline of other ap-

proaches participating in the debate this work contributes to. Finally, I have laid out the roadmap of the thesis, indicating the job that each chapter is doing as part of the whole. I hope that all this will have provided a good framing for the relevance and context of this project and the general direction it is taking.