3. Diagnostic Reasoning as Modelling

In the previous chapters, I offered an overview of the core practices of clinical psychiatric diagnostics (Chapter 1) and presented a methodology for qualitative, constitutive diagnostic modelling (Chapter 2). The separate presentation of these two topics has paved the way for my next step in this chapter. Here, I argue that the process of diagnostic reasoning that psychiatrists engage in during clinical psychiatric diagnostics can be understood as a qualitative, constitutive diagnostic modelling procedure plus an additional layer of processing that should be understood as pattern recognition. Thus I establish my model-based account of psychiatric diagnostic reasoning.

To make plausible that psychiatric diagnostic reasoning can be understood along the lines of my proposal, I will show that the central features of the method described in Chapter 2 maps the diagnostic procedures described in Chapter 1. I will demonstrate that the inferential processes spelled out by the method of diagnostic modelling make for a plausible proposal of how to understand the steps of diagnostic information-processing.[1]

Considering my in-depth discussion of modelling in the last chapter, I propose that the following aspects of qualitative, constitutive diagnostic modelling must be shown to be present in psychiatric diagnostics to make the method plausibly present in psychiatric diagnostics, as well as descriptively adequate and suitable for provide an understanding of the inferential processes of diagnostic information-processing.

The first three criteria derive from the general understanding of modelling (2.1), which follows the three-step procedure of model construal, analysis, and model selection.

1 As discussed in 1.3, diagnostic information-processing as part of the diagnostic process was not included in the descriptive proposal of Chapter 1 since there is no widely upheld understanding of these aspects of the diagnostic process. Rather, an understanding of psychiatrists' processing of diagnostic information is part of what any answer to the Methodological Question must provide a plausible proposal for – one that makes sense of and is constrained by the inputs and outputs to these instances of information-processing.

i) Construe theoretical structures intended to represent the target based on little previous knowledge about the actual target system (construal)
ii) Consider the regularities of the model structure(s) that have been set up (analysis)
iii) Engage in a fidelity criteria-based selection process in which the model(s) are compared to the real-world system and a choice is made to accept or reject the model (model/world comparison and in result model selection)
iv) The model structure(s) must consist of elements and relationships specified in qualitative terms, more specifically as linguistic propositions.

If psychiatric diagnostics can be understood as any kind of modelling process, there should be steps in the diagnostic process that are plausibly interpretable as these three steps of the modelling process. In addition to these criteria, which make it plausible to think of psychiatric diagnostics as modelling at all, I add a fourth criterion to be fulfilled, which makes plausible that diagnostic psychiatric reasoning is, more specifically, qualitative modelling.

v) The model structure(s) must consist of elements and relationships specified in qualitative terms, more specifically as linguistic propositions.

Finally, to establish that psychiatric diagnostics is diagnostic modelling and constitutive modelling as described in the last chapter, the following criteria should be met.

vi) The modelling procedure employs a normative model of the diagnosed system to indicate which outputs of the system qualify as abnormal and classify them accordingly as being at least prima facie errors
vii) The model structure(s) used as error models within the diagnostic process are constitutive models

The diagnostic modelling process may employ either simple normative-model diagnostics or error-model based differential or exclusion diagnostics.

If all these criteria can be shown to be met in psychiatric diagnostics, it seems that the mapping between qualitative, constitutive diagnostic modelling and psychiatric diagnostics holds. This would entail that in considering this method, the further methodological considerations about diagnostic reasoning that I supplied in Chapter 2 can be applied to psychiatric diagnostics. Demonstrating this, plus adding some remarks on the pattern-recognition based stage of psychiatric diagnostics that I will claim to apply in the step of disorder diagnosis selection, will establish my answer to the Methodological Question: the model-based account of psychiatric diagnostic reasoning. My answer will claiming that psychiatric diagnostics is largely

diagnostic modelling process plus one level of pattern recognition. To discuss how clinical diagnostics meets these conditions related to my proposed method of modelling, and what role pattern recognition plays on top of it, I will proceed as follows.

In the first section (3.1), I will look at the initial screening phase of the diagnostic process and its preparation of the in-depth evaluation, and show what criteria of modelling are fulfilled in it. For this, I will introduce three clinical examples and go into more clinical depth than in the first chapter of this book, which was intended primarily to provide a conceptual grasp of each step of the process of psychiatric diagnostics. My examples will be the complaint of reluctant speech, the complaint of constant worrying, and the complaint of relationship problems. I will discuss what potential in-depth diagnostic evaluations these complaints would entail, and what psychiatrists would be interested in when evaluating whether these complaints constitute psychopathological symptoms. Following the presentation of these examples, I will argue that the screening step of the diagnostic process equals a normative-model based *prima facie* error recognition (corresponding to criterion v above) and that the *prima facie* error recognition leads to the diagnostic information-processing that prepares the in-depth evaluation. This evaluation seems to consist of construal (*i*) and analysis (*ii*) of models that are qualitative (*iv*), and constitutive (*vi*) in nature and that serve as diagnostic models. In this way, I will have shown that the diagnostic process meets several of the above-mentioned criteria for it being a qualitative, constitutive diagnostic modelling process (specifically, criteria (*i*), (*ii*), (*iv*), (*v*), and (*vi*)).

Next (3.2), I will take some of the clinical examples discussed so far and ask how to understand the execution of the diagnostic in-depth evaluation that was prepared for in the screening phase. I will argue that carrying out this in-depth evaluation means performing a model/world comparison (*iii*), and will show how this instance of model/world comparison is realised as a form of diagnostic information-processing that equals the diagnostic modelling process of differential or exclusion diagnostics (*vii*). This section will show that the two remaining criteria are met (*iii*, *vii*) and thus that the aspects of psychiatric diagnostics discussed so far can rightfully considered to be qualitative, constitutive diagnostic modelling.

Once this mapping between the diagnostic process and diagnostic modelling is established, I will come to the part of diagnostics not exhausted by modelling. In a third step (1.3), I will use my case examples to discuss how the present psychiatric symptoms identified in the in-depth evaluation of the patient (or as a result of the diagnostic model/world comparison process) are then used to set up the case formulation. The case formulation is a representation of the modelling outcomes, summarising the results explaining its outcomes and thus informing the syndromal disorder diagnosis that is made in accordance with a chosen diagnostic manual. This step of diagnostic information-processing, I will argue, is a pattern recognition process performed by experienced clinicians.

Finally (1.4), I will conclude this chapter by summing up how the proposal thus presented answers the Methodological Question. In Chapter 4 I will then move on to discuss additional desiderata for an answer to the Methodological Question and how my answer is also fulfilling those.

3.1 Screening as Modelling

In the opening phase of clinical information-seeking stands the question: what are the reasons for the patient's admission to the psychiatric institution? This question is initially answered as a result of the part of the diagnostic information-gathering process that functions as screening for complaints. This information will usually be attained directly from the patient during the first clinical encounter by asking for the reasons why he requires psychiatrist services (in the initial phase of the psychiatric interview) and by making initial observations of the patient's behaviour and asking more specific questions and potentially tasks (via mental status examination and testing). Admission charts and family reports may also be used for this purpose. This minimal initial information about the patient provides the psychiatrist with her initial screening impression of the patient and his complaints, providing her with a list of complaints that may qualify as psychiatrically relevant complaints. Such a list might, for example, contain information about the patient reporting "sleep problems", "feeling sad all the time", having "lost pleasure in free time activities", "feeling tired all the time", "worrying a lot", as well as behaviours that give the impression of being potentially psychopathologically relevant – for example, that the patient appears to have "problems concentrating on his actions and the conversation", "shows increased psychomotor activity by rubbing and kneading his hands and chewing his nails", or is "remarkably reluctant and laconic in speech". Thus, complaints may entail subjective reports as well as second- or third-person observations. From such list of complaints, the psychiatrist generates ideas that might explain the patient's complaints. If she sees an option for how one of these complaints might constitute a psychopathological condition, she will further explore the patient's condition to decide whether or not this is the case. Let me make this beginning of the diagnostic process, which I described in its general format in the first chapter, more concrete by discussing the diagnostic procedure for two of the three aforementioned complaints that I will use throughout this chapter to illustrate my argument: the complaints of reluctant speech and constant worrying. I will discuss what initial considerations a psychiatrist may use for their potential in-depth evaluations, as well as what evaluations a psychiatrist may look to carry out in order to determine whether the complaint is a psychopathological symptom, another medical problem, or a distressed but non-pathological state of mind.

3.1.1 Examples of Screening

For the first example, consider the fact that the psychiatrist recognises a patient's unusual speech pattern in the course of their conversation. In the table, a noticeable speech pattern in the left column is contrasted with the normally expected pattern in the right column.

Table 3: Noticeable speech pattern (left). Normal speech pattern (right)

Noticeable	**Normal**
Psychiatrist: Good Morning, Mr Jones. What can I do for you?	**Psychiatrist:** Good Morning, Mr Jones. What can I do for you?
Patient: Help.	**Patient:** I came to you because I have some problems that I think I need help with.
Psychiatrist: And I will try my best to do so. Can you tell me something about the reason you are reaching out for help?	**Psychiatrist:** And I will try my best to do so. Can you tell me something about the reason you are reaching out for help?
Patient: Yes.	**Patient:** Well, thanks. I feel sad and empty, and I do not know what I should do about it. It started […].

If an interview conversation goes on like this, and the patient's language production remains so remarkably laconic, the psychiatrist will come up with the idea that the patient may suffer from a psychiatric condition called alogia. According to Sadock and Sadock. (2008, p. 27), alogia is a "laconic speech condition characterized by a reduction in the quantity of spontaneous speech; replies to questions are brief and unelaborated, and little or no unprompted additional information is provided. Occurs in major depression, schizophrenia, dementia, or schizotypal personality disorders (APA, 2013, p. 817). Alogia is also called "poverty of speech".

As a second example, let me come back to the potential self-description of a patient saying "I worry all the time." If a patient reporting such an indistinct complaint indeed turns out to indicate a psychiatric symptom, there is more than one option for which one it might be. It could be *generalised anxiety*, which is usually understood as "[c]hronic, excessive and uncontrollable worry about multiple topics" (Hirsch et al., 2013, p. 388), or a more specific object/situation-related anxiety of psychopathological value, which would be of similar character but tied to a frequently occurring trigger. Alternatively, this "worry" might also turn out to be a form of compulsive thought that is causing negative emotions in its evaluation. In a clinical context, this could be understood as a specific kind of unwanted, unintended, recurring, and in-

trusive cognitive event whose content is experienced as egodystonic but subjective – that is, a product of the individual's own mind.

Considering the patient's complaints, the psychiatrist will draw on her background knowledge to consider alternative explanations for those that are initially recognised as plausibly indicating psychopathologically relevant problems (such as the two I am offering as examples). Through further evaluation of the patient, she will decide whether the *prima facie* psychiatrically relevant complaint represents a psychiatric symptom, a non-psychiatric medical symptom, or maybe even no medically relevant symptom at all.[2] What may be the various alternative options that the psychiatrist has in mind in her examination of the initial complaint that might speak for one (or another) psychiatric symptom or the alternatives?

Let us again begin by considering the potential case of alogia. Given the observed complaint, several diagnostic hypotheses may come to mind. Each maps onto a diagnostic outcome; some speak for the patient's behaviour being the psychiatric symptom of alogia, while others may suggest alternative medical diagnostic conclusions, or that the complaint has no symptom value at all. The psychiatrist might theorise that:

2 At this point, the question may arise as to whether evaluations of initial complaints of patients in a psychiatric context always include the option of turning out to be only a *prima facie* psychiatric complaint – i.e., to be a non-psychiatric medical problem or not a medical problem at all. One reason to doubt this has been presented to me by a colleague is a patient reporting hearing voices most of the time for some weeks. How could this not be a psychiatric problem? Before I respond to this problem, let me provide a more general answer. It might be possible that there are initial complaints that allow only for an assessment that shows them to be psychiatric. In this case, a further evaluation beyond the recognition of the complaint would not be necessary. Such cases, which would be an exception that I would have to tolerate, are *possible*, but whether they *exist* is another question. I am not aware of such cases, and so I consider them to be at least rare. Now let me come back to the hearing-voices case. It might be that this patient hears voices because they suffer from the psychiatric symptom of hearing voices, which is primarily associated with disorders on the psychotic spectrum but can also occur in depression, for example. However, hearing voices can also result from lesions of acute inflammation of the brain (Silva and Brucki, 2010) and can occur during sleep deprivation and starvation. Even for the initial complaint of hearing voices, therefore, there are explanatory options to evaluate it that would lead to the diagnostic conclusion that the symptom is a non-psychiatric medical complaint or not a medical complaint at all. To make this clear, think of a psychiatrist who is checking the necessary criteria for providing a diagnosis of schizophrenia. Whether or not this diagnosis can be provided depends on the question of whether the patient hears voices. If the patient hears indeed voices but the psychiatrist has good reason to suspect that this is due to lack of sleep, she apparently should not and will not make the diagnosis, since psychiatric diagnosis usually includes those alternative explanations for diagnostically relevant features.

A. The patient did not want to consult the psychiatrist but does so to satisfy relatives or friends who pressure him to do so.
B. The patient might have an unusually pedantic way of speaking, not associated with any morbid condition.
C. The patient may have taken drugs impairing his language-related cognition – e.g., cannabis (Dellazizzo et al., 2022).
D. The patient might have had a traumatic brain injury (TBI) that could have led to this condition.
E. The patient might suffer from specific cognitive deficits in language processing responsible for his speaking behaviour.

Considering this list of possible explanations, they can be matched with the diagnostic outcome that their truth would support. If hypothesis A. were true, the patient's language production would not be a sign of psychiatrist or medical problems; it would be a motivated behaviour expressing his lack of interest in cooperating with the psychiatrist. If B. applied, this would again not be the psychiatric symptom of alogia but rather someone with an unusually pedantic way of speaking – something that happens from time to time and may lead to misdiagnosis. This is a problem that, as the literature indicates (Andreasen, 2016), has been observed particularly in interaction with administrators, politicians, scientists, and (perhaps unsurprisingly) philosophers. If C. applied, the patient's laconic speaking behaviour would be considered a medical problem, namely a temporary drug-induced cognitive alteration of language behaviour, which again is not a symptom of a psychiatric disorder, only an effect of a momentary intoxication.[3] If D. applied, the patient's problem would be considered a medical problem falling under the specialisation of neurology, but

3 At this point you may wonder, why not consider a substance-induced mental alteration (e.g., under the influence of cannabis) that causes an acute speech impairment alogia. Or, as one may ask more generally, why should two hypothetically similar token behaviours or mental states be classified as a psychiatric symptom or sign on one occasion, but as non-psychiatric on another? This is due not to some strong metaphysical distinction, but rather to the special place that psychiatric symptoms and signs currently have in medical semiology (Altable, 2012). In medicine, symptoms are traditionally considered manifestations of a disease, or, to put it in more philosophical terms, they are representations of the presence of disease, and therefore of physiological alterations considered causally responsible for their presence. If a symptom or sign is caused by a disease condition that is not considered a mental disorder, it is, for the purpose of providing diagnoses of psychiatric disorders, not considered to be a psychiatric sign or symptom. This does not mean that, in the end, research might not show that part of the causal pathways responsible for the occurrence of the symptoms is shared by a psychiatric disorder and a disease with similar psychological or behavioural symptoms. In consequence, if a psychiatrist is convinced that the alogia-like change of language production is best explained as a result of the patient's recent consumption of a substance, they will mention the patient's state but not consider this impairment for the further psychopatho-

would again not mean that the patient's complaint would be considered a psychiatric symptom. Based on our current best understanding of alogia as a psychiatric symptom, which I will discuss in detail later, only if hypothesis E. provides the best explanation for the patient's language behaviour will the patient be considered to suffer from alogia as a psychiatric symptom.

In the same way as for the potential case of alogia, the psychiatrist would come up with a list of options to address the complaint about constant worrying:

a. The patient's worry may be the result of an increase of arousal occurring in response to dealing with current high-stress or hostile circumstances.
b. The patient takes medication or drugs on a regular basis that, depending on the dose, can cause anxiety reactions (e.g., corticosteroids or caffeine)
c. The patient's constant worrying turns out to consist in thoughts coming to his mind whose content is not particularly distressing but that cause higher-order distress because of their undesired persistence and their negative appraisal.
d. The patient's worry results from the anticipation of or reaction to a specific frequently occurring stimulus (e.g., a type of situation or object) that he is afraid of to a degree that seems extraordinarily high given its nature.
e. The patient's worry is a specific stimulus-independent reaction to expectation of unlikely menacing events and more likely but unthreatening events.

Again, the different ideas as to how to explain the complaint of the patient would, if they applied, lead to different diagnostic judgements. If a. applied, the patient's

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logical evaluation that feeds into the ascription of a mental disorder – that is, they will not consider it as a symptom of a mental disorder.

Take an example: if the decision as to whether the reluctant speech of a person who has consumed cannabis is considered alogia or not is the tiebreaker in whether the psychiatrist will diagnose schizophrenia, and the psychiatrist has good evidence that the patient does not show this impairment if they are not intoxicated, the psychiatrist would not diagnose schizophrenia. Why not? Because the patient's condition is by definition not a sign of psychiatric disorder; it is substance-induced, and as such, it has a distinct aetiology that in itself does not directly entail a mental disorder (it is a potential addition that would play no role in the diagnostics here). For this reason, many diagnostic manuals offer specific categories for instances of impairment or alteration of cognition and experience specifically as substance-induced. Note that this is not to say that substances may not in the end cause conditions that in themselves will qualify as psychiatric, neurological, or other medical disorders. For example, long-term consumption of alcohol may cause the development of Korsakoff syndrome, which is considered an irreversible form of Wernicke encephalopathy leading in particular to impaired retrograde and anterograde memory and confabulation (Covell and Siddiqui, 2022). The consumption of a range of substances may contribute to the onset and substance-independent persistence of psychosis (Deng et al., 2012).

complaint would be a normal psychological response to current and ongoing life circumstances. If b. applied, the patient's complaints would again be considered not a psychiatric symptom but a side-effect of medication or other substance-induced complaint. If c. applied, the diagnosis might be that instead of suffering from a psychiatric anxiety symptom, the patient suffers from persistent compulsive thoughts, another psychiatric symptom that causes distress. If d. applied, the patient's complaint would be considered stimulus-specific psychopathological anxiety, and finally if e. applied, the complaint would turn out to be a general psychopathological anxiety reaction. So much for the available options for diagnostic evaluations of the initial complaints. However, a well-trained psychiatrist is not only able to come up with the two lists of hypotheses addressing the complaints; she also possesses a knowledge base regarding how to evaluate each hypothesis. This brings me to the next topic of this subsection, namely the considerations undertaken by the psychiatrist as to how to evaluate the diagnostic options in the next step of the diagnostic process: the in-depth evaluation.

To know what to do in the in-depth evaluation, the psychiatrist calls upon their knowledge about what diagnostic information would have to apply to the patient with the complaints in question, to support each of their optional evaluations. We can think of the assumptions that should be true in the case of the patient as a set of interrelated propositions that the psychiatrist can evaluate against to generate diagnostic data about the patient's presentations. These sets of propositions result from the background knowledge in psychiatry (including the predisposing, aetiological, maintaining, and co-occurring factors for psychopathology), general medical background knowledge, as well as folk-psychological understanding of human minds and behaviours. To illustrate what these set of propositions may look like, let me come back to the two complaints and their potential evaluations and expand on three potential diagnostic evaluations of each complaint and what the psychiatrist might look for to verify them. Again I shall begin with the case of reluctant speech.

To discuss the setup for the in-depth evaluation of the potential case of reluctant speech, let us consider three of the aforementioned diagnostic options and what a psychiatrist might look for to validate them. Let us take the non-pathological case of pedantic language use (B.), the actual case of disturbances of language control retrieval in which the patient's complaint would be evaluated as psychiatric symptom alogia (E.), and the case in which the patient's language problem would lead to the evaluation of being a non-psychiatric but medical problem deriving from the option that the patient suffered from traumatic brain injury (D.). Let me start with option B.

To evaluate whether the patient showing the complaint of reluctant speech may just have an atypically reluctant manner of speaking that is normal for the patient (B.), the psychiatrist may set up the following set of propositions:

- The patient can elaborate their answers if asked to.
- The patient recognises that their answers are unusually short and can justify their manner of speaking by explaining their motivation (e.g., wanting to save the doctor's time, or wanting to be as precise as possible).
- The patient can report that his way of presenting information is not something that has developed recently but is rather their normal way of conveying information.

If possible, the psychiatrist also speaks to relatives, friends, or other medical professionals to verify the statement that:

- People who know the patient report that the patient has always tended to speak this way.

If, on the other hand, the psychiatrist wished to evaluate the hypothesis that the patient's language behaviour resulted from a traumatic brain injury (TBI)[4] (D.) they would evaluate the following propositions:

- The patient recently took some sort of blow to the head (e.g., by falling or having an accident).
- The patient did suffer some such blow, and lost consciousness or had loss of memory of events immediately before or after the blow.
- There were alterations of mental states at the time of the accident (e.g., feeling dazed, disoriented, or confused).
- Lesions that indicate traumatic brain damage be seen in computed tomography.

Finally, let me come to the case in which the psychiatrist would like to assess whether the patient's complaint presents a specific language-processing disturbance (E.) that would render their complaints a case of the psychiatric symptom of alogia. For this, let me say a bit more about our current best understanding of alogia in psychiatric sciences.

The chief cognitive impairment behind alogia in psychiatric cases involves an impairment of *control retrieval* – part of the executive functioning that enables the retrieval of information from memory. Alogia occurs when the information is not automatically retrieved, or when there is more than one potential piece of information matching the search profile (Wagner et al., 2001; Doughty and Done, 2009; Docherty, Berenbaum, and Kerns, 2011). If a test of speech production, conducted on a coop-

4 Information about TBI and its evaluation can be found in National Academies of Sciences, Engineering, and Medicine (2019).

erative patient, shows patterns indicating this kind of cognitive impairment, diagnosis of alogia seems warranted. How to evaluate whether such a condition holds?

As already mentioned, alogia is considered a condition deriving from a disorder of the cognitive function of *control retrieval* – a part of the executive function that enables the retrieval of information from memory when either that information is not automatically retrieved or when there is more than one potential piece of information matching the search profile. This cognitive function can be tested with verbal fluency tasks. Such tasks require subjects to follow a production rule in voicing words. They may be required, for example, to say words beginning with a certain letter (testing word–letter fluency) or falling into a category such as *animals* (testing word fluency). More specifically, when being tested for alogia, an individual would be asked to produce lexical items for a certain span of time. If an individual suffers from a cognitive impairment of control retrieval, there is an increased mean response latency between each reported word when asked to produce words in a category. If the individual does not show this deficit, this suggests the impairment of other language-related cognitive functions that, in principle, could also lead to the clinical presentation. These other impairments include disorganised semantic memory (which would lead to poorer performance in category fluency relative to letter fluency) or context processing (which should lead to a decrease in the proportion of correctly reported semantically-related words) (Docherty, Berenbaum, and Kerns, 2011). If verbal fluency testing of the patient meets this prediction, it may be reasonably concluded that the patient's complaints are an instance of the symptom of alogia.

In accordance with these insights into the underlying psychology of alogia, the psychiatrist may put forward a proposition that can be evaluated during an in-depth evaluation in cognitive testing, as described above:

- The patient shows relevantly worsened outcomes in a verbal fluency task.
- The patient shows no impairment in semantic memory.
- The patient shows no impairment in context processing.

Now to the second example I wanted to discuss: the complaint of constant worrying. For this, let us again consider three of the aforementioned evaluations that a psychiatrist may have in mind: constant worrying in the context of permanent arousal due to constantly present stressful circumstances, which would not suggest a psychiatric or non-psychiatric medical problem (a.); constant worrying consisting of thoughts that are not particularly distressing in their content but that cause higher-order distress because of their undesired persistence and their negative appraisal, which would suggest the evaluation of these thoughts as persistent compulsive thoughts, rather than as an anxiety symptom (c.); worrying as a specific stimulus-independent reaction to an expectation of unlikely menacing events and more likely but un-

threatening events, which would suggest that the patient's complaint indicates the presence of a psychopathological general anxiety reaction (e.).

To evaluate whether option a. applies, meaning that the patient does not suffer from a psychiatric or any other medical problem regarding the complaint or constant worry, the psychiatrist would have to evaluate whether:

- The patient is currently in a highly stressful or hostile life situation (e.g., currently being threatened and followed by an ex-partner, or having lost his job and being in significant debt and about to become homeless) that makes the worry reaction seem appropriate.
- The patient's increase in worry coincides with the occurrence and duration of the stressful life circumstances.
- The patient's worries directly concern the source of worry, or the topic of worry is closely linked another worry or a hostile experience. Alternatively, the worry may concern an occurrence that while under normal circumstances would be no problem, is experienced as being an issue because it comes "on top" of the actual severe problems that cause other, primary worries.

Next, let us turn to the case of evaluating whether option c. applies – that is, whether the patient's constant worry is a case of compulsive thought. Compulsive thoughts are an instance of the larger class of psychiatric symptoms that are called intrusive thoughts. Intrusive thought is "any distinct, identifiable cognitive event that is unwanted, unintended, and recurrent. It interrupts the flow of thought, interferes in task performance, is associated with negative affect, and is difficult to control" (Clark and Rhyno, 2005, p. 4). This class of cognitive events contains many psychiatric symptoms, distinguished partly by their content and partly by additional formal features already pointed out by Beck and colleagues (Beck, 1967, 1987; Clark and Beck, 1999) and since then investigated by several researchers (e.g., Rachman, 1978, 1981, 1997, 1998, 2003; Dougall, Craig, and Baum, 1999; Langlois, Freeston, and Ladouceur, 2000a, 2000b; Clark and Rhyno, 2005; Morrison, 2005; Romero-Sanchiz et al., 2017). Other types of intrusive thoughts are ruminative (thoughts concerning personal loss or failure), often seen in depression; intrusive memories, often seen in PTSD; worrying (dealing with threat and vulnerability), often seen in generalised anxiety disorder; hypochondriac fear, as a specific form of an anxiety; and, arguably (Morrison, 2005), thought insertion, as experienced by psychotic patients.

To evaluate whether the patient suffers from frequently occurring compulsive thoughts whose occurrence makes the patient worry about them due to their appraisal, and which induces shame and may damage the patient's self-image, the psychiatrist must evaluate whether what the patient calls constant worry is indeed tied to the phenomenon of compulsive thought. This can be evaluated by checking whether the patient has thoughts that:

- are distinct thoughts, primarily experienced as visual (i.e., visual mental imagery) entering conscious awareness
- are attributed to an internal origin (i.e., the patient assumes ownership of these thoughts)
- are considered unacceptable or unwanted due to their egodystonic nature (i.e., their content is inconsistent with the subject's self-image or moral convictions)
- are evoking significant feelings of shame
- are interfering in ongoing cognitive and/or behavioural activity
- are unintended and nonvolitional or have wilful independence
- are recurrent or repetitive
- are difficult or impossible to control or dispel
- arise more frequently under increased stress

Finally, let me come to the third diagnostic option (e.). This interpretation would be that the patient's complaint of constant worry turns out to be the symptom of generalised anxiety, which is a psychopathological form of worry. Worry, if considered as a psychopathological symptom, can be understood as a "chain of thoughts and images, negatively affect-laden and relatively uncontrollable. The worry process represents an attempt to engage in mental problem-solving on an issue whose outcome is uncertain but contains the possibility of one or more negative outcomes" (Borkovec et al., 1983, p. 10; Sibrava and Borkovec, 2006, p. 1).[5] More particular features making pathological worry identifiable by clinicians have been discovered and replicated in a wide range of research on pathological generalised worry (e.g. Borkovec and Inz, 1990; Wells and Morrison, 1994; Wells, 1995; Clark and Claybourn, 1997; Stöber, 1998; Wells et al., 1999; Stöber et al., 2000; Langlois, Freeston, and Ladouceur, 2000a, 2000b; Hoyer et al., 2001; Stöber and Borkovec, 2002; Ruscio 2002; Lee et al., 2003; Ruscio and Borkovec, 2004; Watkins et al., 2005; Sibrava and Borkovec, 2006; Hirsch and Mathews, 2012; Hirsch et al., 2013). The understanding of pathological generalised worry emerging from this research suggests that it:

- predominantly takes the form of verbal reasoning
- is non-specific, abstract, or general in content (e.g., "what if *the worst* happens?")
- is persistent (i.e., of long duration)
- is closely linked to the individual's current concerns

5 Although at first glance perhaps similar to rumination, another psychiatric symptom, there are relevant and clear differences, most prominently regarding contents. Cognitive phenomena labelled as worry concern thoughts of possible future threats impinging on the individual. Rumination, on the other hand, is usually associated with thoughts whose contents concern past negative events or negative personal attributes (e.g., Watkins et al., 2005; Hirsch et al., 2012).

- is attributed to an internal origin (i.e., the patient assumes ownership of these thoughts)
- is experienced as egosyntonic
- is difficult or impossible to control or dispel
- entails a stress-inducing faulty appraisal concerning whether the feared consequences might come to pass ("worry about worry")
- is thought to have the positive power to potentially prevent the feared event

Accordingly, these would be the features that the clinician would look for in a patient to support the diagnostic assessment that the patient suffers from pathological generalised worry.

So far, I have discussed examples of complaints whose potential evaluation is categorical: either the patient suffers from alogia or not. Such categorical decisions about symptom attributions are significant, since in later stages of the diagnostic process, the absence or presence of this symptom will contribute to determining the symptom-based disorder diagnosis. However, in more recent editions of diagnostic manuals, such as the DSM-5 (APA, 2013) and the ICD-11 (WHO, 2019), the identification of symptoms as either present or absent has been supplemented with dimensional ratings.[6] How does this work? To answer this question, let us take the example of personality disorders, which have seen the most pronounced developments in terms of dimensional diagnostics.

In the new DSM-5 (APA, 2013, pp. 761 ff.), we find an optional module for personality disorder diagnostics that presents a hybrid account of dimensional and categorical judgements of diagnostic features. It includes a Personality Functioning Scale with four dimensions (identity, self-direction, empathy, intimacy) on which patients may be rated on a scale from 0 (little or no impairment) to 3 (severe impairment) and a list of personality features to evaluate as present or absent. Suffi-

6 These changes were introduced following the increased interest in psychiatric research in thinking of at least some psychopathological features as occurring on a spectrum. Dimensional symptom ratings have been introduced as mandatory in the evaluation of diagnostic criteria for some mental disorder categorisations in the DSM-5 (e.g., autism spectrum disorder, intellectual disability) and as optional for others (e.g., primary psychotic disorder and personality disorders). Dimensional ratings have been made mandatory in some disorders categorised by ICD-11 (e.g., autism spectrum disorder, personality disorder) and optional for others (e.g., primary psychotic disorders). Also, they have been adopted in one way or another by relevant research movements in the field, such as the National Institute of Mental Health RDoC Project (NIMH, 2013) and the HiToP Research Consortium (Kotov et al., 2017). Here I will discuss only the case of personality disorders because my sole aim is to show how, in principle, my approach harmonises with this line of diagnostic. Discussing the scientific and clinical motivations for a dimensional understanding of mental disorders is beyond the scope of my project. For discussion of these motivations, see Krueger and Bezdjian, 2009; Helzer et al., 2009; Adam, 2013; Reed et al., 2019.

ciently high ratings on several scales plus the presence of relevant personality features may fulfil the symptom requirements of a syndromal diagnosis of a personality disorder such as schizoid personality disorder. The ICD, by contrast, offers an (almost) purely dimensional account. Like the DSM, it presents us with several domains tracking disturbances in functioning of aspects of the self and disturbances of interpersonal functioning that must each be evaluated for its pervasiveness and severity.[7] Although no explicit rating scale for evaluating these broader domains of self or interpersonal disturbances (like the one presented in the new DSM-5) is given, the new ICD contains a general scale that requires the clinician to judge the patient in their overall personality functioning as having a mild, moderate, or severe personality disorder. However, the new ICD approach to personality disorder diagnostics is only *almost* dimensional because it also contains specific features to add to the diagnosis, called "prominent personality traits or patterns". These denote striking features of personality disorders that previously were hallmark features for the categorical diagnosis of personality disorders. They include "borderline pattern", apparently akin to what previously was considered a borderline personality disorder, and "dissociality", apparently linked to traits previously thought of as specific to antisocial personality disorder.

In the end, the assessment of complaints that might suggest a potential evaluation as a psychopathologically relevant personality feature drawing on the newly introduced dimensional scales for symptoms is not very different from the evaluations discussed so far. For those symptoms whose presence is still intended to be evaluated categorically (character traits in DSM, prominent personality patterns in ICD), there is a clinical understanding of what constitutes these features on the level of the patient's behaviours, cognitions, and experiences such that complaints initially making the presence of this features a reasonable diagnostic possibility than can be evaluated against sets of propositions for the psychiatric symptom in question, as well as alternative models as discussed earlier in this chapter. When it comes to the dimensional assessment of symptoms, diagnostic practice can be best understood as operating such that each level of a symptom in question has an underlying set of propositions for the level of the system that is then intended to be evaluated against the patient, in addition to alternative sets of propositions that would render the complaint not a psychiatric symptom, but instead, for example, a distressing

7 The self-disturbance scale includes stability and coherence of one's sense of identity; ability to maintain an overall positive and stable sense of self-worth; accuracy of one's view of one's characteristics, strengths, limitations; and capacity for self-direction (ability to plan, choose, and implement appropriate goals). The interpersonal functioning group contains: interest in engaging in relationships with others; ability to understand and appreciate others' perspectives; ability to develop and maintain close and mutually satisfying relationships; and ability to manage conflict in relationships.

but not pathological psycho-behavioural occurrence. The DSM and ICD straightforwardly support the idea of evaluating the applicability of a set of propositions against the patient by providing short qualitative description of what features would have to be evaluated for different symptom levels.

If, for example, we consider a patient who reports that she has problems with "knowing what I want", the psychiatrist may include in the list of potential diagnostic evaluations of this complaint a symptom that is a feature of personality pathology, called "self-direction". Evaluating self-directions requires information on (1) the patient's goal-setting and goal-pursuing behaviour, (2) the qualities of the patient's setting and pursuing of normative standards for behaviour; and (3) the patient's capacity to reflect on an interpret the meaning of her own experience. If the individual shows Level 1 of impairment ("some impairment") on the sub-aspect of goal directedness, she is either "excessively goal-directed, somewhat goal-inhibited, or conflicted about goals" (APA, 2013, p. 775), whereas if she shows Level 2 of impairment ("moderate impairment"), "goals are more often means of gaining external approval than self-generated, and thus may lack coherence and/or stability" (ibid., p. 776). From this description of the three levels of the self-direction symptom, one can construe a set of propositions for each level that can then be used as a set of propositions to be evaluated against the patient's presentation in the in-depth evaluation, to support an evaluation of the complaint of "not knowing what one wants" as, for instance, moderate impairment of self-direction.

Similar descriptions can be found for sub-aspects of the descriptions of personality disorders of different severity in the ICD. If we focus solely on the aspect of interpersonal relationships, the description of "moderate personality disorder" (see Bach and First, 2018, Additional File 1) reads as follows:

> There are marked problems in most interpersonal relationships and the performance of most expected social and occupational roles are compromised to some degree. Relationships are likely to be characterized by conflict, avoidance, withdrawal, or extreme dependency (e.g., few friendships maintained, persistent conflict in work relationships and consequent occupational problems, romantic relationships characterized by serious disruption or inappropriate submissiveness).

Meanwhile, in the same symptom domain, someone with "severe personality disorder" is expected to show that their "problems in interpersonal functioning seriously affect virtually all relationships and the ability and willingness to perform expected social and occupational roles is absent or severely compromised" (ibid.).

Thus, if a psychiatrist is diagnosing a patient who reports that she has interpersonal problems that the psychiatrist also picks upon in the screening process, the psychiatrist will set up various sets of propositions to test, via the in-depth evaluation, whether the complaint might indicate a psychopathological problem. The

psychiatrist will also derive sets of propositions from the qualitative descriptions just presented, and will likewise evaluate them in the context of the in-depth evaluation. The derived list of propositions for moderate interpersonal problems might then look like this:

- problems in most private social relationships
- problems in most professional social relationships
- few friendships maintained
- persistent conflict in work relationships and consequent occupational problems
- romantic relationships characterised by serious disruption or inappropriate submissiveness

To give a brief idea of something that might also be considered by a psychiatrist in the case of a complaint regarding recurring interpersonal problems, an alternative evaluation of the complaint of repeated interpersonal problems might be that the patient suffers experiences of repeated social exclusion for other reasons. To take an example from my own clinical work, the patient may suffer from a hearing impairment that leads him to misunderstand or miss what people say if he is not fully concentrated on the conversation, and he may feel bad about his problem and so not tell anyone about it. The result is communication problems that may be misunderstood as ignorance or just weirdness on his part, which leads people to withdraw from him. If we want to put this in a list of features this can look as follows:

- The patient has a physical impairment that complicates communication.
- The patient does not usually speak openly with others, or even actively hides the impairment from them.
- People tend to retreat from social contact with the patient, saying they feel ignored by the patient or that the patient forgets things they have said.

The DSM and the ICD descriptions of the prerequisites for dimensional categorisation in these domains of personality functioning both offer propositional descriptions that differ from each other either in the extent to which a problem seems to be present (as in the ICD example) or in the quality of the phenomenon rather than only in quantity (as in the DSM example). These descriptions can be used as sets of propositions to evaluate the level of the symptom via the in-depth evaluation of the recognised complaints that might indicate these psychopathological problems.

So far, I have discussed clinical examples of the complaints of reluctant speech and constant worrying and have presented some potential clinical evaluations that a psychiatrist may consider if a patient presents with this complaint. I have also spelled out some of what a psychiatrist would look for to support these potential diagnostic evaluations of complaints. In addition, I took a moment to discuss how,

as part of this way of describing the diagnostic procedure, we can understand the relatively new approach of evaluating symptoms by level of severity. Here I outlined the screening step of the diagnostic procedure and the reasoning that takes place in preparation for the in-depth evaluation. Now let me come to the task of mapping part of the criteria for something being a qualitative, constitutive diagnostic modelling process (which I presented in the introduction to this chapter) onto the clinical process illustrated here.

3.1.2 Mapping Modelling onto Screening

Let me now turn from this description of the initial clinical reasoning process, illustrated with specific examples, to show what aspects of diagnostic modelling are embodied by it. I begin by considering the initial screening of the patient, and with it the psychiatrist's initial recognition of their complaints.

As described earlier, the initial screening involves letting the patient report her reasons for wanting to speak with clinician, as well systematically exploring aspects of the patient's experience, including their psychological as well as behavioural functioning, by questioning and observing them. Thus the complaints of the patient are identified. Complaints are abnormalities in the assessed aspects of the patient that might indicate the presence of a psychopathological condition. This initial step of the identification of complaints equals the step of diagnostic modelling that I called *prima facie* error recognition. In this initial step of diagnostic modelling, the diagnostic modeller flags outputs of a system that might indicate an error in the system. This recognition in modelling takes place based on what I called the normative model of the system. This is a model that indicates which kinds of output should be expected in a well-functioning system under the usual conditions in which the system operates. If developed in detail, the model also fleshes out some details about the inner processes of the system associated with normal system outputs.[8] Based on their ideas about how human experience and behaviour, if not potentially psychopathological, is supposed to appear in individuals in what one may consider a rage of normal life circumstances, the psychiatrist (just like the diagnostic modeller) will note the deviations from the assumed range of normality and suspect that these might indicate the presence of a psychopathological symptom that in turn indicates a psychopathological condition in the patient – or an error in the system, as the diagnostic modeller would say. We may think of the background assumptions of the psychiatrist as a long list of features that should be considered within the scope of typical human psycho-behavioural phenomena, not potentially indicating an instance of psychopathology. More specifically, one plausible way to think about these background assumptions made by the psychiatrist is as a large set of propositions

8 For a more detailed articulation, please see Chapter 2.

representing what is assumed to be potentially normal. Such propositions might include: People can fall asleep after being awake for a workday. People have things that bring pleasure to them. People are in in control of their thoughts. If the psychiatrist picks up information about the patient indicating that one of these propositions does not apply to them, this indicates a complaint (in this case, for instance, sleeping problems, loss of interest, or intrusive cognitions) that will be considered for the in-depth evaluation. If we consider such sets of propositions to be qualitative models that are meant to represent a normative state of the system expressed in terms of propositions (which I will make more plausible when I talk about propositional models below), this set of normative assumptions that psychiatrists have in the back of their mind while talking to patients would plausibly qualify as a normative model and the complaints would then plausibly match up with the suspicion of an error in the system evoked by the recognition of a *prima facie* error, which will then guide further diagnostic efforts in diagnostic modelling.[9] This seems to establish the fulfilment of the initially presented criterion (*v*) that there is a normative model at work in the initial recognition of a *prima facie* error.

As we saw above, initially recognised complaints then drive suspicions about potential situations that might have led to their presentation. These suspicions take the form of diagnostic hypotheses that might lead to various evaluative outcomes. The complaint might be evaluated as an actual medical problem that then might either fall either into the realm of psychiatry or be categorised as a medical but non-psychiatric problem. Or the complaint might be evaluated as not being a medical problem at all. These hypotheses, as we saw, come with a set of propositions whose evaluation is used to enable decisions about which diagnostic conclusion should be drawn. But before I come to the process of diagnostic decision-making, let me give a little more time to the advancement of the diagnostic hypotheses and their subordinated sets of propositions, in connection with my understanding of modelling.

At the beginning of the step of diagnostics that I have just discussed, namely screening, the psychiatrist puts forwards multiple ideas as to what might be the patient's problem. These proposals have diagnostic labels (psychopathological condition X, medical non-psychopathological condition Y, or a type of non-medically relevant complaint) that are accompanied by theoretical structures consisting of sets

9 Note that the term *normative model* applied in this situation is theory-neutral insofar as it remains silent about what are or should be the sources of such normative standards. In this way, I can avoid engaging in the ongoing debate between those who consider our understanding of psychopathology to be best analysed in terms of natural functions and those who believe that we must consider normative judgements to feed into our understanding of what counts as mentally healthy or not (on this debate, see, e.g., Faucher and Forest, 2021). Both assumptions are compatible with the idea of the use of a normative model in psychiatric diagnostics; all that would change is what the final justification of such normative assumptions about a well-functioning system would be. The answer to this question does not affect my account.

of interrelated propositions hypothesising certain states to be present (or to have occurred) in the patient and how these states relate to each other or to other states in the patient. These sets of propositions are intended to match aspects of the patient under diagnostic evaluation. The initial diagnostic ideas and their propositionally structured package are put forward by the psychiatrist based on little initial information about the actual patient at hand, usually just the report of an experience offered by the patient or an observation made by the psychiatrist that is in no sense treated as sufficient to establish a diagnostic conclusion right away. The sets of propositions related to each diagnostic label considered to possibly apply to the patient, rather than being informed by substantial information about the patient at hand, is informed by the psychiatrist's scientific and clinical background knowledge as well as their common-sense psychological understanding of the human mind.

Considering this process so far, it seems that the sets of interrelated propositions that are intended to fulfil representational functions in relation to a real-world system (the patient) present a structure that would qualify as a candidate for a propositional model structure (Thomson-Jones, 2012). As discussed in the last chapter, propositional models are not a model in the sense most often used in science, where models are mostly specified as quantitative mathematical structures. Nor is this type of model specified in one of the more formal ways offered by qualitative mathematics, or in terms of a box-and-arrow graphic with a legend that assigns meaning to the components of its structure. Rather, propositional models are qualitative model structures that consist of propositions whose content expresses a state of affairs meant to apply to the real-world system that the model targets. If we stay close to clinical reality – that is, a clinician who thinks about what would have to apply to a patient for their complaint to constitute a certain symptom, which will lead him to bring to mind what has to be true about the patient to have this symptom – it seems natural and *prima facie* most plausible to think of what comes to his mind as a set of language-like propositions presenting a list. Just like the ones I introduced in the last subsection, this list sums up the different facets of what should be true about the patient in order to provide this or that clinical evaluation of a symptom. Thus, when psychiatrists do employ qualitative models in diagnostic reasoning, those models seem to be best understood as models consisting of sets of propositions – that is, as propositional models. Whether these supposedly propositional models really are models, as defined in the approach being presented here, then of course depends on whether these structures are set up and handled in accordance with the indirect strategy of representation. If this turned out to be the case, then PD would meet criterion iv. To take the first step in showing that the whole process indeed qualifies as modelling, let us now turn to how the representational structures used in diagnostics are set up.

To determine whether the theoretical structures used by the psychiatrist to identify complaints and evaluate them diagnostically qualify as model structures

we need to assess whether they are set up and used in the three-step procedure of model construal, model analysis, and model/world comparison, as discussed in detail in the last chapter and as also set out as criteria (*i*), (*ii*), and (*iii*) at the beginning of this chapter. Let us first look at model construal.

The theoretical structures that seem to be used by psychiatrists to target their patients seem to be set up based on little initial background knowledge about the actual system intended to be represented by the regarding structures. Instead, the structure itself is provided from a canon of background theories and the reuse of models from psychopathology, medicine, and common-sense psychology for the conditions that might be present in the patient. The theoretical structures used by the psychiatrist to identify complaints and evaluate their diagnostic status are set up based on various sources of inspiration, but the previous direct investigation of the system makes the process of setting up the structure equivalent to what, in Chapter 2, I discussed as constituting *model construal*. In other words, as discussed, the modeller does not start with an investigation of the modelled system and derive their model from the investigation, but instead brings to the table a pre-established idea of the structure that will be used to represent the modelled system. The psychiatrist has in mind a pre-established understanding of what constitutes complaints and the presence of specific diagnostic evaluations of these complaints, and does not develop such ideas anew when engaging with every single patient. The psychiatrist has a pre-established understanding of psychopathology that he can recall in the form of sets of propositions. It seems, therefore, that the first important point, and criterion (*i*), the model construal, is met. Next up in the process of modelling would be the *model analysis*.

Model analysis is the step in which a modeller considers the implications of the model structure that has been set up. These include which aspects of the real-world system are meant to capture which aspects of the real-world system (*model scope*); which aspects of the model are assigned to which specific parts of a real-world system at hand (*model assignment*); and how well a model's elements and relationships amongst them, including the impact that a change in one part of the model should have on the rest of the model, matches the real-world system's makeup and behaviour (*representational and dynamic fidelity criteria*). The model analysis step is typically explicitly present in modelling only if a model is being set up for the first time or is being undertaken more thoroughly than usual by someone using a pre-established model or using a model derived from a theory when this model is newly learned. An experienced modeller who commonly uses one and the same model structure multiple times will not need to analyse the model every time it is used, because they already know its implications. This is also the case with diagnostic experts.

Think of a psychiatrist who is well trained in the theoretical understanding and clinical appearance of the symptoms of anhedonia. He does not have to think

through his knowledge of anhedonia to become aware of the model's assumptions and its implications every time he considers a patient to suffer from this symptom. He will know them by heart. Such well-established knowledge of a clinician about any symptom will encompass the different aspects of model analysis – setting the scope of the model, model assignment, and providing representational and dynamic fidelity criteria – as such knowledge about symptoms entails a good understanding of propositions, describing states or dispositions whose absence or presence are relevant to come to diagnostic decisions regarding the presence of complaints and symptoms. This understanding includes which features of patients are relevant to look at (*scope of the model)* and which propositions are referring to which features of the patient (*model assignment*) – which is rather self-suggesting by the proposition's content (i.e., the meaning of the words in the proposition). All that is needed is an adequate understanding of these meanings of the content of the propositions. Take, for example, a diagnostic proposition that the patient wakes up at night in terror because of bad dreams. It would be clear that the scope of this proposition, which makes its target part of the scope of the overall model, would by virtue of the proposition's content be the patient's sleep behaviour and dream experiences, and also that the aspect of model assignment for this proposition as part of the model would be taken care of by its meaning – namely, the target of this specific proposition would be the patient's sleep behaviour and dream experiences.[10] Now let me come to the last aspect of model analysis setup: fidelity criteria.

The thorough understanding of psychopathology that diagnostic experts such as well-trained psychiatrists bring to the table also takes care of the last aspect of model analysis, fidelity criteria. To recall, fidelity criteria are the criteria for how well a given model structure (in our case this would be a set of propositions) is supposed to map onto the elements or processes of the model's real-world target in order to consider the model permissible. Showing that diagnostic reasoning preparing the in-depth evaluation also sets up fidelity criteria requires a bit more discussion. This discussion is required thanks to the role played by vagueness in this context, which may initially provoke doubt if indeed fidelity criteria are generally assumed. If not, this would undermine my claim that model analysis takes place, and that this portion of diagnostic reasoning is modelling at all, thus endangering my whole project. Therefore, I will argue that what we see in diagnostic reasoning that employs natural language propositions is the occasional vagueness that we encounter in language on a regular basis, which does not mean that fidelity criteria are absent; they are just

10 A mathematical model, on the other hand, consisting only of quantitative constants and variables would not be so straightforwardly interpreted. Language-like propositions have a content whose meaning is indicative of its target, while for numbers and symbols being mapped onto a feature of a system, either widely known conventions or intentional assignments are needed.

vague sometimes. As is often the case with qualitative theorising, cut-offs for when a qualitative representational structure such as natural language propositions map onto its target have vaguer boundaries than quantitative representational structures employing numerical values that can be mapped onto numerical measurement outcomes of real-world systems.

In the case of the theoretical structures, vagueness comes into psychiatric diagnostics on the level of diagnostic propositions. First, propositions used to evaluate potential diagnostic interpretations of the patient's presentation are in themselves vague, and second, it is vague how many of these propositions must apply to justify the assumption that the theoretical structure maps onto the target. Let me discuss both aspects. Regarding the vagueness of diagnostic propositions, we may notice that they often contain vague phrases. By this I mean phrases that by virtue of their meaning do not provide a clear-cut criterion for when they should be applied, but leave room for borderline cases. Borderline cases in normal language use are, for example, the use of the word "dusk", where it is hard to say when exactly it begins or ends, or the correct application of the phrase "heap of sand", when we look at a growing collection of grains of sand asking ourselves how many grains are needed to make a heap. In diagnostic propositions we do not talk about dusk or sand but sometimes, as in the set of propositions for pathological generalised worry discussed earlier, similar vagueness creeps in. We read that worry is "difficult or impossible to dispel" rather than easy to dispel. But when exactly does it become difficult rather than easy to dispel a worry? It seems that in attempting to pin down the meaning of "hard-to-dispel worry", we cannot provide a definite answer. Or consider another diagnostic proposition saying that worries are supposed to be "closely" linked to current concerns. How close is closely, and when does the worry start to be linked distally or semi-closely? Or, to take another example that will be discussed below in detail, look at a part of the ICD-11 (WHO, 2019) criteria for severe personality disorder: "problems in interpersonal functioning seriously affect virtually all relationships". Again, when precisely do the effects start to be "serious", and how many of the relationships must be affected to count as "virtually all"? There might be clear cases in which we would say that it is hard rather than easy for someone to dispel a worry, that a worry is closely linked to current occurrences rather than only distally linked, and that virtually all rather than only many of a person's relationships are affected, but there may also be cases where we struggle to draw the line between these alternative evaluations. The vagueness of the applicability of single diagnostic propositions propagates to the set of propositions containing them. If vagueness can make it challenging to determine whether one proposition of a set of propositions apply to a patient, the same will be true when the task is to decide whether the set of propositions applies to a patient if one part of the set is a proposition that actualised the problem of vagueness in a concrete case that the set should be applied to. Therefore, although diagnostic propositions can be considered to inform a diagnostic expert

about their fidelity criteria by virtue of their meaning, the fidelity criteria via which they do are in themselves not clear cut.

However, vagueness of criteria is not the same as absence of criteria. Although we encounter vagueness in the employment of diagnostic propositions by clinicians, this does not mean that clinicians assess the presence of psychopathological conditions in their patients with no idea when a proposition matches with the patient's presentation and when not. It is simply the case that in some instances, it will be not straightforward to decide this question, and these cases are borderline cases. In these cases, just as in the case of model scope and model assignment, fidelity criteria are present, in the form of the meaning of the propositions, but when exactly the proposition applies will on occasion be undecidable due to the vagueness of these meanings.[11]

A further point worth noting about fidelity criteria is that, just as in any other case of modelling, the purpose of fidelity criteria is to say how good the match between model and world must be in order to accept the model as a model of the real-world system, and this purpose allows for some error. We also see this indicated explicitly in sets of diagnostic propositions. This occurs most obviously in cases where diagnostic propositions themselves contain phrases like "usually", "often", or "regularly". Again, in the case of pathological generalised worry, we might say that these worries are supposed to "predominantly take the form of verbal reasoning". That means that there will also be cases where these pathological worries are not verbal. So, it seems that this proposition, although likely true, does not *have* to be true in order for a psychiatrist to apply the label of pathological worry that is provided based on the match between diagnosis proposition and a patient. On other occasions, this room for error may not be directly expressed in the proposition (though it could be) but will be considered by the psychiatrist based on common background knowledge.

11 It is worth noting that occasionally a psychiatrist will make decisions regarding borderline cases influenced by non-theoretical factors, practising higher-order reasoning in the clinical context. To explore these practical rationales systematically is beyond the scope of this chapter and would strictly speaking no longer fall under diagnostic reasoning proper, rather addressing an impact of practical clinical reasoning on diagnostic reasoning. Think, for example, of the potential positive and negative consequences that the decision may have for the patient. If, in the end, ascribing this proposition would lead to the ascription of a symptom that would lead to a diagnosis that would in turn have a serious negative impact on the patient's life – for example, lead to the prescription of medication with severe side-effects or impact the patient's ability to work in certain sectors – these complications may make the clinician who has the overall good of their patient in mind hesitate to count borderline cases as positives and inclined to make conservative diagnostic decisions. The same may apply the other way around if the potential prescription of medication that might save the patient's life, and whose prescription would have no serious side-effects, depended on a positive evaluation of a borderline case. In these cases, many clinicians will find themselves inclined to be more liberal in their judgements.

If, for example, we look at traumatic brain injuries (TBI) discussed earlier (section 4.1.2), they contain the criterion that lesions that indicate traumatic brain damage can be seen in computed tomography. If one digs into the relevant literature (see the original discussion of TBI for references), it is clear that if enough of the other expected aspects of TBI are present, clinicians are nonetheless willing to diagnose TBI even if there is no lesion on the CT.

It seems that each set of diagnostic propositions (or propositional diagnostic models, as I suggest we can consider them) also has its fidelity criteria for which and perhaps how many propositions must apply contingently or necessarily to make the propositional model map well enough onto the patient presentation to make the model acceptable.

We know the requirement that some core features must apply, and then other features may apply. However, in difference to higher levels of diagnostic decision making (the formalised criteria for what symptoms must be present in order to diagnose a certain disorder according to DSM or ICD) on the level of symptom diagnostics we are currently looking at there is no official standardised manual. Instead, the clinician's psychopathological, medical, and commonsensical psychological understanding of the specific potential diagnosis they are evaluating will influence how well they expect the model of, for instance, pathological generalised worry to map onto the patient reporting constant worrying, and whether they infer that it is matched well enough to accept this model for the patient. This might even result in differences on the level of diagnostic decision-making regarding the attribution of symptoms, depending on how up-to-date the clinician's understanding of the relevant condition is. This is a topic that will be explored in more depth in the next chapter when I discuss diagnostic errors and disagreements.

Considering the discussions in the preceding paragraphs, we find that there are fidelity criteria, though they are occasionally vague, for the sets of propositions used for diagnostic purposes. This means that all steps of model analysis (scope, assignment, fidelity criteria) take place in diagnostic reasoning as it can be expected to proceed in cases in which well-known models (here, sets of diagnostic propositions) are reused by experienced modellers (psychiatrists), such that criterion (*ii*) *model analysis* can be considered fulfilled. Now let me come to the last criterion, criterion *(iv) constitutive models*, that I will show to apply to the screening procedure.

As a last point in this section, I want to show that the procedure described above employs theoretical structures that, assuming they are models, would meet the requirements of the initially introduced criterion (*iv*), and thus can be considered constitutive models. As discussed in detail in the last chapter, to qualify as constitutive, models must point out factors of the system that they attempt to represent that, if present, would be components of the system providing it with the power (or disposition) to bring about the phenomenon that the diagnostic model is intended to indicate. Does this apply to the sets of propositions used in psychiatric diagnostics

if we consider them to be models? I have two reasons to think so. One is a *prima facie* reason, making this option more plausible; the second is a reason that can be demonstrated via examples, as I will do by coming back to the case of pathological generalised worry. Let me begin with the *prima facie* reason.

The *prima facie* reason to believe that if diagnostic reasoning is modelling, it is constitutive modelling is that there is a constraint on what kinds of modelling it could be, and among the alternatives, constitutive models seem to be the most plausibly attainable in clinical diagnostic contexts. Let me elaborate. As briefly mentioned in the Introduction and discussed in detail in Chapter 1, it seems that models used for diagnostic purposes must do explanatory work, since it is required of the diagnostic process that it produce a case formulation equipped with the capacity to explain the patient's condition. If this case formulation is derived from the earlier diagnostic process, and if we accept that this process is a modelling process (as I argue it is), the explanatory power of the case formulation must be generated by the diagnostic modelling process that provides the material for the formulation. This in turn means that the models from which the formulation would derive must do explanatory work. If we commit to the requirement of explanation and modelling and thus locate the source of explanatory power in the modelling process informing the diagnostic case formulation, two relevant class of models discussed in detail in the last chapter are potentially option: explanatory modelling may be either causal or constitutive. Let me give a quick reminder of what we are talking about when we talk about causal or constitutive models.

Causal models would aim to point out the causal aetiology – that is, the chain of events and its stages – of the occurrence of an output of the system, such as the complaint of the client. A causal model explaining a type of symptom to be present in a system would have to explain it as a causal consequence of a specific kind (or class) of causal process; it would say *why* the system is doing what it is doing. To then diagnose a condition with such a model, we would need to evaluate whether the causal story that the model tells us is in place within the patient. Using a constitutive model, by contrast, allows us to dispense with looking at the exact causal processes in the system because, to quote Cummins (2000, p. 122) again, such a model "abstract[s] away from the behavior and orchestrated activities of the parts and ask[s] how the system has a capacity for this kind of behavior". Abstracting away from causal details in this way makes things easier. It will ostensibly often be simpler to identify reliable constituents of a system on some level of description that our investigation tells us is responsible for an output, and then to assess the presence or absence of these features, than it is to come up with a detailed explanation entailing all these components, plus a story about how their interactions produce the output in question, and then to assess whether precisely this process has taken place. Finding reliable causal explanations for phenomena is a notoriously complicated task, especially in complex systems like human minds and behaviours, and it is usually easier

to merely identify the components that presumably put the system in the position of producing the output, without getting into the details of why they do this.

Considering these two forms of explanatory modelling, a brief look at psychiatric diagnostics makes it implausible that, if it is modelling, what is being used in it are causal models. It is implausible because psychopathology has produced virtually no such models that could be used for diagnostics, nor do the methods of assessment in psychiatry seem to be suited to evaluate causal claims. Let me elaborate. Causal models of how specific symptoms emerge that are widely accepted as the basis of a psychopathological understanding of specific symptoms that is also used as the basis of clinical assessments, and that track down the relevant causal process that can be assumed to generally occur in patients if they suffer from a symptom, are beyond the current reach of psychiatric science. Considering the current state of our psychopathological understanding, we arguably have no widely accepted model for psychiatric symptoms of major psychiatric disorders that allows us to understand the causal process producing it and that could be used in clinical practice. There is, for example, no causal model of hearing voices in schizophrenia that is widely accepted in psychopathology, that is so reliable that it is used to assess whether a patient reporting hearing voices even though no one is present is suffering from verbal hallucinations. Such models may be developed and used in the future, but they are not part of clinical reality at present.

Moreover, commonly used diagnostic procedures at the core of diagnostic practice seem to carry out a comparison between a causal model and the presentation of the patient that would allow us to infer causal relationships. In psychiatric interviewing, the mental status examination, or the commonly used cognitive tests as discussed in the examples in this section, it does not seem that what is being assessed in the models are either a) counterfactual relationships amongst the elements (i.e., propositions) of the models, as would be required by a counterfactual approach to causality (Menzies and Beebee, 2020), or b) alternative criteria commonly treated as indicating causality, such as the Bradford Hill criteria (Hill, 1965), which track down plausible causal pathways or identify strengths of association between supposedly causally interacting elements (e.g., dose–response relationships). Nor do the models ensure what has more recently (Cartwright, 2022) been claimed to be required to support causal claims in single cases, like the "elimination of alternatives" (ibid.) ensuring that no sources of bias are present (i.e., proclaim and control causally biasing variables).

One might suggest an objection at this point. The sets of propositions I have provided may indeed often point to features that would plausibly also play a role in the causal story of how the complaint occurs in the diagnosed patient. However, setting up a model of a system that is representing crucial features of a system that contribute to an output of the system, such that by the application of the model the presence of these features is evaluated, is something different from setting up

a model of the causal process of which the features of the system addressed in the model are part. We might start with the simple fact that the latter case will contain a claim about some elements causally influencing other elements, while the earlier model, addressing features alone, will not make claims about such causal dynamics amongst model elements. A diagnostic proposition – for example, the one indicating a blow to the head with loss of consciousness and other mental complaints assessed in the context of the assessment of reluctant speech being due to TBI – certainly assesses a feature of the system (i.e., having been in a certain state due to a specified occurrence) that plausibly may also have played a role in a causal story of the psychological complaint, if this complaint is indeed connected to a case of TBI. But this proposition makes no claim about the occurrence causing the reluctant speech, nor is there any mention of how this proposition is supposed to be linked to the other propositions in the model to indicate causal relationships between them. Of course, it would be highly plausible that, to pick out another diagnostic proposition, a brain lesion found in a CT might be the result of an impact to the head, and we might be very likely to consider this to be the case if both propositions apply. However, the model itself does not establish this claim or provide guidance to assess any causal relationship between a potential blow to the head plus its immediate psychological consequences and the finding of a brain lesion. It just asks us to evaluate whether the patient has experienced such a blow to the head and/or has a brain lesion; it does not engage in causal claims.

What to make of this? If the propositional models used in psychiatry are perhaps not causal models, given the lack of a good causal understanding of psychiatric symptoms in psychopathology, and the apparent fact that the diagnostic evaluations are not tracking down information suited to evaluating causation (although they do identify features of the system that play a role in the system executing the causal capacity to produce the complaint) this should ring a bell: These features might instead be constitutive factors. However, to support the claim with more than a plausibility argument, let me present my second reason.

The second reason why I argue that the sets of propositions used by psychiatrists, if they are models, qualify as constitutive models derives from how they are best understood to account for the evaluation of a complaint. To illustrate this, I will look again at the set of propositions used to evaluate the presence of pathological generalised worry. Here again is the set of propositions proposed to be used to evaluate this condition:

- predominantly takes the form of verbal reasoning
- is non-specific, abstract, or general in content (e.g., "what if *the worst* happens?")
- is persistent (i.e., of long duration)
- is closely linked to the individual's current concerns

- is attributed to an internal origin (i.e., the patient assumes ownership of these thoughts)
- is experienced as egosyntonic
- is difficult or impossible to control or dispel
- entails a stress-inducing faulty appraisal concerning whether the feared consequences might come to pass ("worry about worry")
- is thought to have the positive power to potentially prevent the feared event.

If we think of this set of propositions as a model, this model consists of nine propositions. Taken as a whole, the model presents criteria to be met by a patient experiencing constant worries in order for these worries to be evaluated as suffering from pathological generalised worry (PGW). In other words, if we think of the experience of constant worry as an executed disposition of the system producing them, rather than just an occurrence, this propositional model points out factors that should be true of the system, actualising or executing the disposition to constantly worry, in order to justify the evaluation of the worrying as PGW. Again, it does not seem to provide a causal account as to why these worries occur. What instead makes the features pointed out by the proposition's constitutive factors – that is, features that justify us in saying that the executed disposition is PGW – is the idea within the model that it is this feature of the worrying system that makes this worry be the executed disposition of PGW. To come back to the example from the last chapter, what makes something have the disposition to be fragile is (given some background conditions) that it breaks when falling from hip height, so that the feature of breaking when falling from hip height is a feature of glass that constitutes its fragility. Similarly, it is experiencing worries as egosyntonic, the worries being predominantly in the form of verbal reasoning (and so on), that makes the occurrence of constant worry the actualised disposition of PGW. In this way, these features are supposed to account for the instances of worrying as being the execution of the disposition to PGW, just as the feature of breaking when being dropped from hip height is what makes something have the attributed disposition of fragility, which is executed when dropped. Thus, what is pointed out by the model and therefore looked for in the patient's evaluation are constituents of their psychopathological state, thought of as dispositions. These dispositions will thereby be explained by providing the constitutive features that are relevant to make the difference between evaluating the system as having this disposition and (if these features were absent) not having this disposition.[12]

12 You might note that the features pointed out by diagnostic propositions are widely different things. Some features of what a disposition requires for its attribution may involve, for example, something having happened to the system in the past; this can therefore be a constituent of the system having this disposition. Imagine there were the disposition to go to heaven after death and we had a word for it. If to have this disposition a human had to be touched by a

The same could be shown for the other examples of collections of propositions employed for the purpose of diagnostic assessment that I discussed in 3.1.1. It therefore appears that if we consider these sets of propositions – set up as the outcomes of the screening procedure to be used for the in-depth evaluation – to be propositional models, these models, which have to do explanatory work to support the subsequent diagnostic case formulation, are constitutive (rather than causal) in nature. Hence, criterion (*vi*), which requires that the models used in psychiatric diagnostics be constitutive, is fulfilled. And thus, all criteria I intended to show to apply to this stage of the diagnostic process apply.

In this section I began to argue that a large part of the diagnostic process can be understood as qualitative, constitutive diagnostic modelling. To do so, I showed how several of the criteria I set out in the introduction to this chapter that must match with the diagnostic process do indeed apply to the diagnostic screening process and the preparations made within it for the in-depth evaluation. More precisely, I argued that the screening procedure and the preparatory steps for the in-depth evaluation can be matched with criteria (*i*), (*ii*), (*iv*), (*v*), and (*vi*). I showed that if we think of the theoretical structures used by psychiatrists in their reasoning as models, the initial error recognition can be thought to take place *qua* normative models (*v*); that if we think of theoretical structures employed by psychiatrists in the context of diagnostic reasoning as models they should be assumed to be qualitative, more precisely propositional models (*iv*); that if we think of them as models, they should most plausibly considered to be constitutive models (*vi*); and that the way the psychiatrists derive and think about the theoretical structures used in the context of diagnostic reasoning corresponds to what we would expect of model construal (*i*) and model analysis (*ii*). To show that diagnostic reasoning can indeed be understood in large part as modelling, only one more criterion must be demonstrated to apply – namely, that a model/world comparison (criterion (*iii*)) takes place, and more specifically that diagnostic reasoning is the kind of diagnostic modelling I presented in the last chapter. I then still need to show that it employs model-based exclusion and differential diagnostic (criterion (*vii*)). Presenting arguments in support of both criteria will be the task of the next section.

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holy person, at least one constituent for having the disposition of going to heaven would be something that occurred to the system in the past. There is no problem with considering such instances and other features of the system that are not physical parts of the system here and now to be constituents for it having a disposition. Thus, it is no problem that diagnostic sets of propositions meant to enable diagnostic evaluation of complaints as types of dispositions contain propositions referring to such features.

3.2 Diagnostic In-Depth Evaluation as Modelling

The last section focused on the screening procedure in psychiatric diagnostics and how it sets up the next stage, the in-depth evaluation. This section will focus on in-depth evaluation and how the criteria set out in the introduction of this chapter are realised by it. I will argue that in the in-depth evaluation we see the model/world comparison take place (criterion (*iii*)) and that we observe the occurrence of model-based differential and exclusion diagnostics (criterion (*vii*)). By demonstrating this, I will show that the screening and in depth-evaluation together meet all seven criteria I set out to be required to support the claim that this portion of the diagnostic process can be understood as operating via the method of qualitative, constitutive diagnostic modelling.

As I did in the last section, I will begin this section by discussing the progression of a potential clinical evaluation, based on the setup I provided in the last section. After a short recap of what in-depth evaluation is all about, I will (3.2.1) continue to use examples to illustrate this step of the diagnostic process. After this illustration, I will then (3.2.2) argue how criteria (*iii)* and (*vii*) apply to this part of the diagnostic process to drive home my point that screening and in-depth evaluation taken together are the portion of diagnostics that can be explained as following the method of diagnostic modelling discussed in the last chapter.

3.2.1 Example of In-Depth Evaluation

With the end of the systematic screening[13] procedure providing a list of patient's complaints and, based on these complaints, a list of several diagnostic evaluations of the complaints, the psychiatrist arrives at a set of diagnostic propositions for each of the diagnostic options for evaluating the complaint. Deciding which of the potential diagnostic evaluations should be selected to classify the complaint in terms of

13 Systematicity here means that the psychiatrist is not only considering spontaneous reports of the patient but also asks about unmentioned potential complaints that, if present, would also require more careful diagnostic attention. If, for example, in the course of this evaluation, the psychiatrist asks about the patient's relationship to his own body, or his body awareness, the patient may say that he often feels as if he were not in his body but "standing behind myself" or "not really looking though my eyes but like through swimming googles" – experiences that appear normal to the patient because, as he reports, he has had them from time to time for as long as he can remember. The description, however, suggest an anomaly that on closer investigation might turn out to be a mental symptom, namely *depersonalisation*, and the psychiatrist will include it in the list of complaints and come up with models that might apply to the patient's case, which in turn enable him to determine whether this complaint indeed is this mental symptom.

its psychopathological relevance is the job of the following step, the in depth-evaluation. In the in-depth evaluation, the psychiatrist evaluates the sets of propositions that make up the relevant understanding of what it is to have a psychiatric symptom, medical symptom, or non-medical complaint against the patient's presentation to select the corresponding set of propositions and, in accordance with this, the appropriate diagnostic categorisation. Let us look at this process in more detail.

In the in-depth evaluation, the psychiatrist is guided by the sets of propositions that have been selected in accordance with their ability to support potential evaluations of these complaints as psychopathological symptoms. The sets of propositions relevant to evaluating each complaint suggest what information would be necessary to support or refute the applicability of each proposition to the patient's presentation. The psychiatrist therefore begins a non-random but rather guided process to generate a set of information about the patient, specifically geared towards assessing the applicability of diagnostic propositions that require evaluation. The main means are, as discussed in the first chapter, interviewing and behavioural observation of the patient (MSE, psychiatric interview) and potentially also information gathered from their relatives, as well as potential further cognitive and biological testing. The information generated in these ways is collected and organised, be it only in the psychiatrist's mind or on their notepad, to present what in the last chapter I called a *prepared description* of the targeted system allowing for the evaluation of the set of diagnostic propositions.

Once the relevant diagnostic information has been collected and ordered, the preselected sets of diagnostic propositions can be compared with the collected diagnostic information for the specific purpose of evaluating which of these propositions apply to the patient at hand. The basic idea is then that this competence enables a decision of which (if any) of the sets of propositions apply, so that the diagnostic evaluation belonging to this set of propositions can be inferred. If the relevant set of diagnostic propositions is similar enough to the presentation of the patient – that is, if the fidelity criteria determining how good the match between model and real-world target must be are met – the evaluation will be accepted; if not, it will be rejected.

As discussed in the last section, to determine whether a proposition applies or not, and whether enough of the propositions apply (given that not all of them need to apply in any given case), is a task that may be impacted by the vagueness of fidelity criteria giving rise to borderline cases. This vagueness leave room for diagnostic judgement that must be exercised in the face of irreducible uncertainty in borderline cases. Let us look at this whole process again considering our examples.

Consider once more the patient's complaint of uncommon speech production, as observed by the psychiatrist in the context of the initial screening situation. Various potential states of affairs might be responsible for this presentation of the patient. Three of them were introduced: one where it would turn out that the patient is

not suffering from any medically relevant symptom, either psychiatric or otherwise; one (traumatic brain injury; TBI) where the complaint would prove to be a medical-neurological problem; and finally, one (alogia) that would turn out to be a psychiatric symptom. To evaluate the first option, I considered the following set of propositions:

- The patient can elaborate their answers if asked to.
- The patient recognises that their answers are unusually short and can justify their manner of speaking by explaining their motivation (e.g., wanting to save the doctor's time, or wanting to be as precise as possible).
- The patient can report that his way of presenting information is not something that has developed recently but is rather their normal way of conveying information.
- People who know the patient report that the patient has always tended to speak this way.

To collect the necessary information about the patient to evaluate all the propositions that would support the evaluation of the complaint of reluctant speech according to this set of propositions and thus as an idiosyncratic and non-pathological manner of speaking, the psychiatrist can straightforwardly find out all he needs to know in conversation with the patient. She can simply ask the patient to elaborate an answer (first diagnostic proposition); can make the fact that the answers provided by the patient are rather short itself a topic in the interview and inquire into whether the patient is aware of the shortness of his answers and whether he is intentionally providing them in such a telegraphic style (second diagnostic proposition); can ask whether this way of speaking is typical for the patient or not (third diagnostic proposition); and may support the certainty of this last point by also speaking to people who know the patient better – likely to a family member (fourth diagnostic proposition).

If we alternatively consider the evaluation of speaking behaviour as not normal and also not a psychiatric symptom, but as the psychological side-effect of the non-psychiatric medical condition of TBI, the following propositions would have to hold true:

- The patient recently took some sort of blow to the head (e.g., by falling or having an accident).
- The patient did suffer some such blow, and lost consciousness or had loss of memory of events immediately before or after the blow.
- There were alterations of mental states at the time of the accident (e.g., feeling dazed, disoriented, or confused).
- Lesions that indicate traumatic brain damage be seen in computed tomography.

Again, the psychiatrist may gather the information relevant to fuel the prepared description of the patient by asking the patient questions to find out whether the patient recently took a blow to the head (e.g., in an accident) or by consulting medical records regarding potential accidents shortly before the patient saw the psychiatrist. The psychiatrist may ask whether the patient felt dazed, disoriented, or confused and order a CT scan of the patient's brain.

Finally, to see whether the patient's speaking behaviour is an instance of the psychiatric symptom of alogia, the following propositions were to be assessed:

- The patient shown relevantly worsened outcomes in a verbal fluency task.
- The patient shows no impairment in semantic memory.
- The patient shows no impairment in context processing.

To gather the information required to evaluate this set of diagnostic propositions and add it to the prepared description of the patient, the psychiatrist would have to conduct cognitive testing assessing the patient's verbal fluency, semantic memory, and context processing to assess the presence or absence of the required patterns of impairments in these functions associated with an impaired execution function of controlled retrieval, since these are considered to co-occur with the complaint of reluctant speech when it is a case of alogia.

Just as I laid out for the in-depth evaluation of three potential diagnostic evaluations potentially applicable to the complaint of reluctant speech, the same could be done for the other symptoms we are familiar with from the last section: the complaint of reluctant speech, for example, or the complaint of interpersonal problems that was discussed in the context of dimensional symptom diagnostics. But I think the principle is clear and that going through this in detail would be a rather repetitive exercise. I will therefore simply outline in brief how this task would be approached for these two examples.

To evaluate the complaint of constant worry again, the sets of diagnostic propositions would be evaluated by questioning the patient. In particular, questions might address his current life situation, to evaluate whether the patient's reactions are best understood as a non-pathological reaction to hostile living circumstances. Inquiries might also target the patient's worry-related experiences, such as the content of their experience (i.e., the content of cognitive states considered to be worry), their attitudes towards (or appraisal of) these experiences, and the patterns of occurrence of these experiences (i.e., under what circumstances, how often, and for how long they occur). The answers to these questions would in turn be relevant to evaluating whether the patient's complaints fit the criteria for compulsive thoughts or generalised anxiety. Rather than going into more detail on the evaluation of this and other complaints, I will now proceed to discussion of another topic: dimensional diagnosis and how it may be evaluated.

To evaluate the complaint of recurring interpersonal problems, regarding the possibility of whether it may be a case of personality pathology such as "moderate interpersonal problems", the psychiatrist would interview the patient and maybe people from the patient's social circle, if possible, to assess where their problems occur (in personal relationships and/or professional contexts), whether the patient is able to maintain friendships and if so how many, whether conflicts occur persistently or only occasionally or in specific circumstances, and whether the patient's romantic relationships seem to be constantly characterised by serious disruptions or are apparently showing the patient to be extremely submissive towards their partner. To gather the information that might be relevant to distinguish among alternative explanations, the psychiatrist would then also consider evaluating the patient's physical health by asking questions and potentially consulting medical records, to see whether the patient may suffer from any impairments that might impact social interaction. If any such impairments were found, the psychiatrist would inquire into how, if at all, the patient communicates with others about these impairments, as well as whether people who tend to have conflicts with the patient indicate that their problem with the patient results from an impression that might result from how the patient's impairments impact their communication behaviour.

Once diagnostic information has been collected, guided by the sets of propositions that are assumed to constitute the space of plausible evaluations of the presented complaints, the psychiatrist arrives at a prepared description of the patient. This description is prepared in that it resulted from the psychiatrist's skilful use of diagnostic tools to assess propositions about the patient, such that the resulting overall grasp of the patient's situation can be thought of as itself presenting a list of propositions stating facts about the patient, geared towards the purpose of comparing the diagnostic sets of propositions against the description of the patient to judge which of the patient's complaint, should, in accordance with the matching sets of diagnostic propositions, be judged to qualify as a psychiatric symptom, a psychobehavioural aspect of a non-psychiatric disease, or just a distressing or unusual but not (psycho)pathological condition. However, the process of comparing the different sets of propositions to the prepared description of the patient's presentation is a relatively complex task; we need to look at it in some detail to do it justice.

By comparing different sets of diagnostic propositions to the patient's data to select which diagnostic evaluation a patient's complaint should receive, the diagnostic procedure in psychiatry, as well as in many other branches of medicine, regularly takes two forms: differential diagnostics and exclusion diagnostics (which is a special instance of differential diagnostics rather than a whole different type). Differential diagnostics as well as exclusion diagnostics are approaches to using sets of diagnostic propositions to assess initial complaints of patients in order to decide between different diagnostic interpretations of these complaints. Let me briefly

present the basic idea behind these two approaches in diagnostics and then discuss another clinical example.

In differential diagnostics decisions between different diagnostic interpretations occurs by deciding which set of diagnostic propositions is best realised by the patient in the context of their complaint. The potential candidates will consist of only those diagnostic options whose diagnostic propositions suit the patient's presentation well enough to be appear plausible. From among these sufficiently well-fitting sets of propositions, the best-fitting one – that is, the one best supported by diagnostic information – will be selected to provide the diagnostic conclusion (i.e., the complaint X is the symptom Y or Z). When precisely a set of propositions can be considered to fit the presentation of a patient sufficiently well to be considered in principle applicable (if no other set of propositions fits the patient's presentation better) is a decision that must be made by the clinician in light of the assumed fidelity criteria for the specific diagnostic option, which (as discussed in 2.1) derive from the overall psychopathological background knowledge about the condition from which the set of propositions is derived.

Exclusion diagnostics takes place in a similar manner, with one exception. Exclusion diagnostics also compares sets of diagnostic propositions in a diagnostic evaluation of complaints against the patient's presentation. However, by contrast with an instance of differential diagnostics, an outcome that can also enable a diagnostic conclusion here is that none of the diagnostic set of propositions applies that would render the patient's presentation a certain type of psychiatric symptom, a psychological aspect of a non-psychiatric medical problem, or a non-pathological psychological distress. If this is the case, the complaint will usually be judged to be a psychiatric complaint, though one that lacks any deeper constitutive understanding.

In the case of exclusion diagnostics, the diagnostic label is chosen not because the patient's presentation matches up with a constitutive understanding of the corresponding psychiatric symptom, but also not because it was present as a complaint. In other words, the label is not positively identified due to its matching with a psychopathologically constitutive understanding of this psychopathological condition as opposed to some other pathological or non-pathological condition, nor is the evaluation provided simply because there was a report of a complaint. There is no direct inference from the presence of a complaint to the symptom diagnosis, but there is still relevant diagnostic effort in comparing alternative sets of diagnostic propositions to account for the complaint in play, although they all fail in the case of an exclusion diagnosis. Why is this important? Because this supports my point that diagnostic evaluations do not result straightforwardly from merely classifying complaints, but that there is always a layer of in-depth evaluation at work. Exclusion diagnostics occurs if no other set of diagnostic propositions appears to map sufficiently well onto the patient's diagnostic information to support a diagnostic inference that the

psychiatric symptom in question is present, so that the absence of evidence for an alternative diagnosis is taken to support the classification as the remaining option for providing a diagnostic label.

Although the logic behind both inferential pathways is straightforward, another example for this instance of diagnostic practice might be useful. An example of exclusion diagnostics may be especially helpful, since imagining a differential diagnostic process based on my previous discussion should be straightforward. In the case of constant worry, or reluctant speech, I have rather extensively discussed their potential diagnostic evaluations and the sets of propositions that would be compared to the prepared description of the patient in order to decide which evaluation to choose. We can readily imagine how a comparative judgement of differential diagnostics would proceed: evaluating the applicability of all these sets of propositions, judging which of them in principle apply sufficiently well to embrace them, and then picking the one that best suits the patient's presentation. Exclusion diagnostics, on the other hand, seems to be a format of diagnostic inference that is less well covered by the basic setup of evaluating complaints that I provided in my discussion of screening, and it might therefore be harder to grasp.

To explore a case of exclusion diagnostics, let us consider the patient presenting with the complaint of hearing voices in the absence of someone speaking. In recognition of this complaint, the psychiatrist will consider different potential diagnostic evaluations. On the one hand, hearing voices may be an instance of auditory hallucinations as a psychiatric symptom that occurs, for example, in the context of schizophrenia, bipolar disorder, schizoaffective disorder, severe depression, borderline personality disorder, and post-traumatic stress disorder (Choong, Hunter, and Woodruff, 2007; Waters et al., 2017). Alternatively, we know that hearing voices also occurs outside the realm of psychiatry narrowly understood – that is, in cases that would not count it towards being a symptom of (for example) schizophrenia. Hearing voices can be the result of (among others) acute sleep deprivation (Waters et al., 2018), malnutrition (Mittal, 2010), coeliac disease (Lindberg, Marco, and Klas, 2013), brain tumours (Madhusoodanan et al., 2004), certain forms of encephalitis (Silva and Brucki, 2010; Boyd et al., 2013; Kayser et al., 2013), traumatic brain injury (Sachdev, Smith, and Cathcart, 2001), sensory deprivation (Mason and Brady, 2009); it can also be a side-effect of prescription medications (Abou et al., 2015) or substance abuse (Fiorentini et al., 2021). The complaint of hearing voices might also occur as a normal phenomenon, such as in hypnagogic and hypnopompic experiences (Ohayon et al., 1996; Waters et al. 2016).

We have some understanding for such non-psychopathological circumstances that may accompany the complaint of hearing voices. In terms of the here discussed approach to diagnostics that means we can draw on sets of constitutive propositions that would enable us to evaluate them as occurring in the context of the system's execution of the disposition to hear voices. In context of such evaluation it would be

judged that this disposition is actualised so that it would not be psychopathological symptom. For example, we know that hearing voices as a hypnagogic/hypnopompic experience occurs only during the transitions from wakefulness to sleep or the other way around, respectively; that people usually know that they are not real; and that the experiences are fleeting and are interrupted if one is fully woken. Things look different in our current understanding of auditory hallucinations as sign of psychiatric disorders. Outside of the contexts that would lead to its evaluation as a non-psychiatric medical complaint, a non-pathological sign of psychological distress, or just a normal psychological occurrence, voice-hearing is poorly understood. Commonsensical positive characterisations of voice-hearing – beyond the complaint-level description that characterises psychopathological instances of it – are hard to come by. Under circumstances in which the psychiatrist does not have a way to evaluate each potential diagnostic option *qua* testing a set of propositions that should state facts about the individual suspected to suffer from a certain condition, the psychiatrist instead evaluates each diagnostic option that he has sets of propositions for. If none of these applies sufficiently well to the patient's case to provide a potential basis for drawing a positive diagnostic inference to the applicable evaluation, the remaining option is a psychiatric symptom (i.e., *auditory verbal hallucinations*), which provides the result of the diagnostic evaluation of the complaint.

Having considered the step of in-depth evaluation in general and discussed its occurrence in differential and exclusion diagnostics, I now want to come to the second task of this section: showing that this step of diagnostics allows me to map criterion (*iii*) (model/world comparison) and criterion (*vii*) (error-model based differential and exclusion diagnostics) onto this step of the process. The success of this step is crucial, since it will complete the list of criteria given in the Introduction and therefore show that this part of diagnostics can be understood as qualitative, constitutive diagnostic modelling.

3.2.2 In-Depth Evaluation as Modelling

It is straightforward to show that diagnostic in-depth evaluation can be considered model/world comparison (criterion (*iii*)) and error-model based differential and exclusion diagnostics (criterion (*vii*)). If we consider the theoretical structures used by clinicians in the in-depth evaluation – that is, the sets of diagnostic propositions – what they do with these structures is compare them with relevant information about the system that provides insight into the actual the patient regarding those aspects that are targeted by the theoretical structure. By collecting this information and putting it together in an overall description of the patient containing the information relevant to assessing the relevant diagnostic models against the patient, clinicians compare the propositional structures they construed and analysed in the context of the screening phase with the real-world system they were set up to target

in the context of the diagnostic process. By so doing, they can judge which of the propositional theoretical structures (if any) match with the real-world system and decide based on the outcome of this process which models to accept and which models to reject based on established fidelity criteria. Thus, after what I argued should be understood as the steps of model construal and analysis, psychiatrists now carry out the matching process described in the last chapter as the act of model/world comparison. There, model/world comparison was introduced as precisely this: the last step of the modelling process in which a theoretical structure – one that is intended to target a real-world system and that was previously set up in a procedure of model construal and analysis – is compared to the real-world system considering the intended assignments, fidelity, and scope of the theoretical structure, to decide whether the structure maps well enough onto the chosen real-world target to be considered permissible. Given this characterisation, and assuming the success of my earlier attempts to demonstrate that a process that can be thought of as model construal and analysis takes place previously in the diagnostic process, I consider it fair to conclude that in depth-evaluation can be considered to exemplify model/world comparison. Thus criterion (iii) is fulfilled, which was the last criterion needed to complete the selection of criteria (i), (*ii*), and (*iii*) needed to show that there is a modelling process taking place in the diagnostic reasoning process. Next let me turn to criterion (*vii*).

The diagnostic reasoning process taking place in psychiatric diagnostics meets criterion (*vii*) and thus uses diagnostic sets of propositions (considered as models) in a diagnostic modelling process that employs differential diagnostic and exclusion diagnostic modelling. As described in the last subsection, the in-depth evaluation tackles the diagnostic evaluation of complaints recognised in the screening phase with the help of sets of diagnostic propositions based on previously recognised complaints. To this end, the clinician collects information about the patient suitable for evaluating these propositions in order to generate a prepared description of the patient. Once all information is there, the psychiatrist begins to compare the propositional diagnostic models against the prepared description. As I described, this happens in two *modi operandi,* differential diagnostics and exclusion diagnostics, where exclusion diagnostics is one path that differential diagnostic may turn out to take, rather than an independent approach.

Considering what has been said about model-based diagnostics, more particular model based differential and exclusion diagnostics, it seems that the way in which propositional models are illustrated to be used by psychiatrist for psychiatric differential and exclusion diagnostics match up neatly. If we think of the complaint recognised in the screening process as constituting the *prima facie* error, which is the starting point of the diagnostic modelling process described in the last chapter, and of the sets of diagnostic propositions used by psychiatrists as diagnostic models, then the diagnostic process of differential diagnostics in psychiatry – just like the

differential diagnostic modelling procedure – is meant to be a comparison between different models in light of a description of the target system. The models are meant to match in order to allow the *prima facie* error produced by the system to be classified as a certain type of error. This match also seems to occur for exclusion diagnostics. In exclusion diagnostics, the sets of propositions compared to relevant features of the patient not leading to a match between one of the sets of propositions enables the exclusion diagnostic determination of the classification of the patient's complaint. This matches up with what was set out in the last chapter about exclusion diagnostic modelling. There, I discussed how in exclusion diagnostic modelling, after the recognition of *prima facie* errors, the modeller will compare a selection of diagnostic models against the system producing the *prima facie* error, reserving a specific label in the diagnostic taxonomy to be applied to the system in case none of the diagnostic models matches with the system. In conclusion, these parallels seem to warrant the conclusion that the in-depth evaluation process meets criterion (*vii*) and thus embodies the use of differential and exclusion diagnostic modelling.[14] This means that all criteria I set out in the Introduction are now mapped onto the steps of the diagnostic psychiatric process that have been discussed so far. We can therefore understand psychiatric diagnostics as following the method of qualitative, constitutive diagnostic modelling as described in the previous chapter. However, the parts of diagnostic process that have been considered so far are not the whole story.

The remaining aspect of the diagnostic process and the reasoning process that psychiatrists go through to complete it has not been covered by the modelling procedure outlined so far. However, the rest of the process, namely the final step of for-

14 We covered the instantiation of both pathways of error-model based diagnostic decision processes at the end of a psychiatric evaluation or in model/world comparison. The remaining form of diagnostic conclusion-drawing that I discussed in the last chapter but not here is *normative-model based diagnostic conclusion-drawing*. An instance of this kind of diagnostics would involve the psychiatrist recognising a patient's complaint and making a straightforward inference from the recognised complaint to the diagnostic judgement of the presence of a psychiatric symptom, since the initial complaint occurs so unambiguously only in the presence of this symptom that the complaint automatically has a symptom value – i.e., the complaint is the symptom. In terms of modelling, this would mean that based on the normative model, an initial error in the system is recognised that is so unique that it only allows for one diagnostic evaluation, making further investigation (i.e., in terms of error models) unnecessary. To my knowledge and judging from discussions with other expert clinicians, there are no cases like this in diagnostic evaluation if it is carried out properly and with expert clinical knowledge. Counterexamples I have been presented with so far seem to suffer from the problem that they consider as part of the initial error recognition or the complaint registration information that according to my description would be part of the in-depth evaluation. Accepting such cases would collapse steps that I am trying to keep distinct in my approach, and would confuse normative-model based diagnostics with error-model based diagnostics and initial recognition of errors with deep analysis of a system.

mulating the diagnostic proposal based as an outcome of the in-depth evaluation, capitalises heavily on the process already described. This is why I call my overall proposal the model-based approach. In the next section, I will look at the last part of diagnostic conclusion-drawing and propose how to understand this part in terms of the ways in which it draws on the previous modelling process and also goes beyond it to propose a final syndromal diagnosis in accordance with diagnostic manuals.

3.3 The Diagnostic Proposal as a Synthesis of Modelling Outcomes and Pattern Recognition

As the psychiatrist ends their diagnostic information-gathering and makes up their mind about which of the patient's complaints should be evaluated as which kind of psychiatric symptom (or alternatively as a psycho-behavioural problem associated with a non-psychiatric medical problem, or a distressing but not pathological psycho-behavioural complaint), it is time to provide a diagnostic proposal. The diagnostic proposal, as discussed in the first chapter, contains two elements: the case formulation and the syndromal diagnosis.

In the case formulation, the psychiatrist organises the diagnostic information that has been obtained and the diagnostic evaluations that are supported by them in a way that allows the reader to understand the evidence determining which of the patient's complaints were given which diagnostic evaluation. The mental construction of the case formulation provides and makes transparent the justification for the symptom-related decision, and therefore also indirectly the justification for the disorder-diagnostic decision that must then be made. As such, the case formulation will contain information regarding all differential or exclusion diagnostic decisions and will therefore present an overall propositional representation of the psychiatrist's diagnostic understanding of the relevant findings in the patient's case, such that it becomes clear which findings about the patient led to the evaluation of which complaint as which symptom (or non-symptom). The written version of the case formulation that may become part of the patient's medical file, or that the psychiatrist may present at a case conferences among colleagues, will often be shorter than this full-fledged version for pragmatic reasons such as limits on time and space. This version will, for example, often only contain information about which propositions were found to apply and contribute to the resulting evaluation of each complaint, and no information about precisely why every other diagnostic possibility that was taken into consideration was ultimately rejected.

As part of the case formulation, we also sometimes see working hypotheses about causal connections between conditions – that is, relationships to be proposed between the patient's symptoms. In cases where a proposition supporting a diagnostic evaluation appears to be causally related to the occurrence of other

propositions, this hypothesised but not evaluated causal relationship may be included as a hypothesis in the formulation. For example, a patient may suffer from sleeping problems (initially considered as potentially the psychiatric symptom of *insomnia)* that are evaluated not to be a psychiatric symptom, since it was decided through the in-depth evaluation that no psychiatric problem are present, but another sleep-disrupting medical problem (e.g., chronic pain[15]) is present. Likewise, the patient's loss of interest and pleasure in activities he once liked (initially considered as potentially indicating *anhedonia*) is evaluated as resulting from a lack of energy due to lack of sleep. In this case, the psychiatrist might point out the assumed causal relationship (chronic pain sleeping problems low energy lack of interest) in the case formulation.[16] However, psychiatrists will not find more or less causal proposals for all relations amongst symptoms; therefore, this aspect of the case formulation is contingent. Thus, on the level of the case formulation, the symptoms or otherwise classified complaints assumed to be present in the patient are also related causally in ways that occur plausible as part of the process of synthesising information from diagnostic evaluations.

The case formulation developed in this way does, as required by the DSM (see the discussion in Chapter 1), explain the patient's psychopathological status in two ways. On the one hand, it offers the more robust, vertical method *qua* constitutive explanation. This is based on the evaluation of constitutive models of the conditions judged to be present against the patient's presentation. The results of this modelling feed up from the lower-level diagnostic modelling process into the case formulation (hence is vertical). On the other hand, the case formulation offers the weaker, more speculative, horizontal causal consideration, which may be proposed by the psychiatrist without specific evaluations against the actual presentation of the patient, but solely by recognising the present complaints and perhaps by drawing on some information about the order in which they occurred (since temporal order allows for a plausible suggestion that one problem might be the cause of another) and the time at which any of the complaints got better or worse (since associations between improvement and worsening of complaints could indicate causal connections). Thus,

15 This is a problem reported by more than 50% of patients suffering from long-standing sleeping problems (Ohayon, 2002, 2005).

16 Pointing out such suspected causal relationships is reminiscent of an approach to psychopathology that has been growing in popularity: the network theory of mental disorder (e.g., Borsboom, 2017). Roughly speaking, this theory attempts to understand mental disorders as networks of symptoms causing and perpetuating each other, and offers clinicians ways to intervene in disorders by addressing specific causally relevant nodes in the network. While Borsboom and others have made great efforts to develop this approach into an empirical research paradigm, I think it is fair to say that clinicians have been thinking in this way in the context of case formulations and their uses throughout the entire history of literature on diagnostic case formulations.

relationships on the (horizontal) level of complaints that seem plausible can be articulated. The case formulation therefore explains the present condition primarily *qua* the constitutive explanatory support that justifies claims about which conditions is claimed to be present in the patient. Secondarily the case formulation provides speculative hinges on the causal relationships between aspects of the presentation. In so doing, it does what the APA (2013) requires. It "recognize[s] when the combination of predisposing, precipitating, perpetuating and protective factors […] [have] resulted in a psychopathological condition" (ibid., p. 19) by making use of such factors in the context of the constitutive models used to identify psychiatric symptoms, and by also allowing for some causal speculations regarding "social, psychological, and biological factors that may have constituted to developing a given mental disorder" (ibid.).

With the case formulation as the summary of the overall diagnostic evaluation via diagnostic modelling that specifies the psychiatric symptoms of the patient, plus some causal speculations expressed in it, the psychiatrist can also provide the syndromal diagnosis. Based on the list of identified psychiatric symptoms backed up by the case formulation, the psychiatrist will select a syndromal psychiatric diagnosis according to the rules of the diagnostic manual in use, currently usually either the DSM-5 or the ICD-10 or ICD-11. While someone new to psychiatric diagnostics will not be familiar with the exact criteria of each diagnosis, the trained expert familiar with the manual will be able to make this inference from the list of recognised psychiatric symptoms to the correct manual-based diagnosis relatively effortlessly. The patient may thereby receive one diagnosis or – not uncommonly – multiple diagnoses.

The syndromal diagnosis whose attributions are justified by the presence of clusters of symptoms, which in turn are justified by the model-based attribution of symptoms, then relates to the modelling process, which provides the ultimate justification. The attribution itself, however, is itself not modelling but a rather straightforward recognition of certain patterns of required symptoms plus the consideration of certain additional rules for diagnostic attribution – for example, that some diagnoses will not be given if the criteria for others are fulfilled. If someone fulfils one of the potential sets of criteria for a major depression, they will also meet all criteria of a mild depression, but in this case one is supposed to diagnose only the major depression. Or if criteria for an anxiety diagnosis and a depression diagnosis are both met, one is supposed to minimise the diagnostic entities attributed and instead of diagnosing both, one should rather opt for a diagnosis of depression with anxiety features. However, despite these additional rules on the level of syndrome attribution, which are meant to foster parsimonious attribution of syndromal entities, the process is otherwise straightforward for anyone who has learned to match symptom patterns with syndromes by heart. To capture this aspect of the diagnostic process, which is based on the outcomes of the diagnostic machinery

of modelling that is feeding in information about recognised symptoms, I propose – in line with research on medical cognition (e.g., Conderre et al., 2003; Groves, O'Rourke, and Alexander, 2003; Loveday et al., 2013) – to understand it as a form of prototype-based pattern recognition. What do I mean by this?

The prototype theory of pattern recognition in cognitive psychology is a model of pattern recognition as a cognitive process, according to which different prototypes of objects are memorised by the system:

> in the process of pattern recognition, outside simulation only needs to be compared with the prototype, and the sense to objects comes from the matching between input information and prototype. Once outside simulating information matches best with a certain prototype in the brain, the information can be ranged in the category of that prototype and recognized. (Pi et al., 2008, p. 435)

If we are understanding the process by which, from a list of symptoms, psychiatrists infer matching syndromes, this would mean that they know the relevant combinations of symptoms that would support a disorder diagnosis as prototypical patterns of symptoms that are inferred once the outside information (i.e., a recognised pattern of symptoms as proposed by the case formulation) is recognised. This recognition then cues the relevant prototype that is associated with the diagnosis matching the pattern of symptoms.[17]

As a result, the process of setting up the diagnostic proposal consists in the cognitive synthesis of the information that is generated as an outcome of the in-depth evaluation, especially the information in which complaints of the patient are evaluated as psychiatric symptoms. In addition to this synthesis, which presents the selected models for the patient's complaints, the psychiatrist may offer potential causal interpretations of relationships between different facts about the patient that were found to hold true in the evaluation of diagnostically relevant propositions, so as to add an extra, though usually rather speculative, layer of causal explanation to the diagnostic outcomes whose primary justification is constitutive. Subsequently, the list of attributed symptoms is used as a baseline of questions that – for psychiatrists who are well trained and aware of the pattern's symptoms and the constraints of potential additional requirements and diagnostic rules (e.g., mutually exclusive

17 If knowledge about prototypes is lacking in a psychiatrist – for example, because they are a novice or there have been recent changes in diagnostic manuals (or because they just want to double-check the criteria) – the automatic cue-based procedure may also be turned into a lookup-and-match process in which the psychiatrist recognises the pattern in a more effortful comparison between a certain set of symptoms and the diagnostic manual's requirements for symptom combinations sufficient for a diagnosis. However, in this context I assume that diagnostic experts are aware of diagnostic rules and of sufficient combinations of symptoms for a given diagnosis.

diagnoses, diagnostic label minimisation) – can then be used to rapidly recognise the potential prototypically occurring patterns of symptoms that support one syndromal diagnosis over another and infer its presence according to the diagnostic manual. Thus, the diagnostic case formulation as well as the disorder diagnostic proposal are produced as the outputs of the diagnostic procedure.

3.4 Conclusion

This chapter has synthesised the material from the previous two chapters on psychiatric diagnostics and diagnostic modelling, arguing that the process of psychiatric diagnostics can be largely understood as a qualitative, constitutive modelling process followed by an inferential procedure that relies on pattern recognition. To support this argument, I proposed seven criteria that map onto the diagnostic process. I then provided a detailed discussion of the diagnostic screening procedure and the in-depth evaluation, using examples to illustrate how these steps and the diagnostic reasoning guiding the transitions between them exemplify the proposed criteria. In the final section, I discussed the diagnostic proposal, which consists of the case formulation and the syndromal disorder diagnosis. I explained how the case formulation is derived from previous modelling efforts and potentially influenced by causal considerations. I also discussed how the inferences from recognised psychiatric symptoms are made using a straightforward pattern recognition procedure in accordance with the diagnostic manual's rules, which dictate the prototype knowledge presentations regarding symptom patterns that psychiatrists keep in mind when determining which syndromes to diagnose based on the list of present symptoms.

This chapter marks a significant step in my attempt to present and defend my answer to the Methodological Question. By showing how my primarily model-based proposal meets the first requirement of the Methodological Question and provides a descriptively adequate account of the basic process of psychiatric diagnostic reasoning, I have set the stage for fulfilling the second and third requirements. These tasks were already addressed in the previous chapter, where I discussed the inferential strategy of model-based diagnostics and its justification. Given that the overall description of diagnostic reasoning presented in the previous chapter applies to psychiatric diagnostics, it follows that the other aspects of the methodology also apply. Therefore, this chapter establishes the applicability of the proposed methodology of qualitative, constitutive diagnostic modelling to psychiatric diagnostics, and also, with the pattern recognition proposal, offers a straightforward account that complements the modelling procedure to explain the rest of the diagnostic process, resulting in a compete answer to the Methodological Question.

Having presented my proposal for answering the Methodological Question, which includes a description of the process, a rationale for the inferential procedure, and a discussion of its justification, I now aim to demonstrate that my proposal goes beyond mere adequacy and satisfies the additional criteria for a good answer to the Methodological Question outlined in the Introduction to this thesis.