4 fMRI-Based Exploratory Search for the Neural Basis of Hysterical Symptoms

In the previous chapter, I have analysed how scientists use fMRI to generate insights into the neural underpinnings of hysterical symptoms. My analysis has focused on examining the operations that researchers perform and the judgments they make while producing and interpreting functional brain maps within the context of a particular study. Building on this analysis, the current chapter will provide a more general overview of the process of knowledge generation in fMRI hysteria research on the whole. Specifically, my aim in this chapter is to articulate what, following Friedrich Steinle, I have until now only summarily characterised as the exploratory character of the fMRI-based hysteria research.[1] By this, I mean the constructive role of this research in producing new empirically derived insights into a disorder that lacks an undisputed theoretical framework. To put it more directly, since the neural basis of hysterical symptoms is unknown, the very goal of fMRI-based experimental research is to discover it. Therefore, the question to which we are now turning is: What kinds of insights into the neural underpinning of various hysterical symptoms has the systematic fMRI exploratory investigation produced in the first two decades of the twenty-first century and how?[2]

As defined by Steinle, exploratory experimentation lacks a pre-established, stable theoretical framework within which it could be conceived, carried out, and evaluated.[3] Yet, Steinle has fittingly pointed out that exploratory experimentation "is by no means necessarily a matter of mindless playing around with the apparatus or merely a trial-and-error process."[4] Instead, this type of experimentation relies on the systematic

1 For details, see section 2.4.1.

2 The discussion in this chapter also builds on my analysis in section 2.3.3. In that section, I argued that after a few initially sporadic studies, in the first decade of the twenty-first century, the current fMRI-based investigation of hysteria has coalesced into a distinct and systematic research endeavour.

3 By introducing the distinction between theory-driven and exploratory experiments, Steinle has argued against the "so-called standard view, in which the role of experiment, as handmaiden to theory, is confined to the testing of hypotheses and theories." Steinle, *Exploratory Experiments*, 4.

4 Steinle, 313.

and targeted "variation of a large number of experimental parameters" to establish the empirical regularities that characterise the phenomenon under investigation.[5] Moreover, as Steinle emphasised, although this process of knowledge generation is not theory-driven, it is nevertheless not entirely theory-free. This is because before they begin their exploratory experimentation, researchers must first formulate provisional "concepts and categories capable of imposing a preliminary structure on the domain in question."[6] Such preliminary concepts play a crucial role in making sense of the newly discovered empirical regularities as "tools required for their expression."[7] Just as importantly, preliminary concepts also have a heuristic function since they are "used in conceiving the experiment."[8] The heuristic or "action-guiding" function of such concepts consists in yielding testable empirical predictions about the phenomenon of interest, which then guide the subsequent process of data generation.[9]

Crucially, Steinle has insisted that in exploratory experiments, we should reject the received view "of concepts as exhaustively captured by their *definitions*," by which he means "the totality of 'theoretical' assumptions about their referents."[10] Instead, he has argued that "[a]ction-guiding concepts" are "early expositions of and 'interpretive possibilities' for new phenomena, provisional in nature and wide open to revision."[11] As such, action-guiding concepts may be "compatible with several theories or with none."[12] Some of these concepts can be "uncertain or vague" from the outset and remain so throughout the experiment,[13] while others may be more clearly defined, to begin with. Yet, in scientific practice, what matters far more than the actual referential contents (i.e., definitions) of these concepts is their "character as doing and enabling specific work for specific tasks."[14] As Steinle has pointedly put it, the central question is whether

5 Steinle, 314, 316–18. In the case of exploratory research into hysteria's underlying neural mechanisms, the specific experimental parameters are determined by the procedural logic of an fMRI experiment and were delineated in detail in the previous chapter. These include the number of experimental subjects and their characteristics, the type of the task and the details of its concrete implementation, the technical parameters of the fMRI data acquisition, and the conditions of the data analysis that entails multiple preprocessing and processing steps.

6 Steinle, 318. In introducing the distinction between theory and preliminary concepts, Steinle differentiates between widely accepted and systematised high-level explanations about a phenomenon under study, on the one hand, and as yet unproven empirical assumptions about that phenomenon, on the other. Ibid., 317–19. In exploratory experiments, systematised high-level explanations (i.e., 'theory') are missing so that researchers work instead with preliminary concepts.

7 Steinle, 313–14.

8 Steinle, 320.

9 Steinle, 313.

10 Feest and Steinle, "Scientific Concepts," 3 (emphasis in original).

11 Steinle, *Exploratory Experiments*, 321.

12 Steinle, 321–22. These assumptions—i.e., preliminary concepts—may be borrowed from different theoretical frameworks. This, as I intend to show, is often the case in fMRI hysteria research. However, we will see that even when pre-existing concepts are adopted from other domains—such as cognitive neuroscience—their applicability and epistemic relevance concerning hysteria are initially uncertain and must be tested experimentally.

13 Steinle, 48.

14 Steinle, "Goals and Fates of Concepts," 105.

a particular concept is "useful or useless" regarding the specific goals of a particular experimental practice.[15]

Hence, Steinle's understanding of action-guiding concepts primarily foregrounds their operational character that is determined by the context of exploratory experiments in which they are used. Action-guiding concepts are thus, first and foremost, understood in instrumental terms—as a set of more or less clearly defined preliminary theoretical assumptions and empirical notions that serve to organise targeted variations across multiple arrangements of experimental parameters.[16] The exploratory experimentation, in turn, has the role of evaluating, readjusting, revising, possibly discarding and, finally, stabilising such action-guiding concepts. In sum, according to Steinle, the essential characteristic of exploratory research is a dynamic process of mutually entangled experimental activity and conceptualisation, during which "new concepts are formed and stabilized—or destabilized."[17]

Drawing on Steinle, in this chapter, I will take a closer look at the action-guiding concepts that have been deployed in the fMRI-based hysteria research in the first two decades of the twenty-first century.[18] Based on my analysis of the individual studies,[19] I argue that these action-guiding concepts can be grouped into four distinct types that emerged approximately in the chronological order in which I list them here and continue to inform the current research. The first type comprises malingering and hypnosis. These two action-guiding concepts can be described as 'uncertain or vague' for reasons I will discuss later. In current medical terms, malingering is defined as the intentional feigning of symptoms with the explicit aim of deceiving the physician.[20] Moreover, in fMRI hysteria research, hypnosis is currently understood in purely neurophysiological terms as an artificially induced altered state of consciousness conducive to the controlled production of symptoms similar to those exhibited by hysteria patients.[21] Both malingering and hypnosis allow researchers to experimentally search for the neural underpinnings specific to hysteria through comparison to physical manifestations that, at least on the surface, resemble genuine hysterical symptoms.[22] By contrast, the second type of action-guiding concept is deployed to structure fMRI experiments aimed at elucidating the neural mechanisms underlying hysteria patients' subjective experiences of their symptoms, such as the perceived lack of voluntary control

15 Steinle, 105. To quote Steinle's example: "'Vegetable' is a useful concept for greengrocers, but not for botanists, while the concept of 'rose-family' is useful for botanists, but not for florists." Ibid.

16 See Steinle, *Exploratory Experiments*, 313–16, and, in particular, 320–22.

17 Steinle, 6.

18 In this chapter, it is strictly in Steinle's operational sense (i.e., as a set of either empirical and theoretical notions, whose role is to organise the exploratory experimental activity) that I will use the term concept. As my analysis above has shown, according to this view, it is primarily through their systematic deployment across multiple experimental setups that particular preliminary assumptions about the phenomena under investigation acquire the status of action-guiding concepts.

19 For the complete list of studies, see footnotes 490 and 491 in chapter 2.

20 For a medical definition of malingering, see, e.g., APA, *DSM-IV*, 451, 474; and APA, *DSM-5*, 321.

21 See section 3.1.2.

22 See, e.g., Cojan et al., "Self-Control"; and Stone et al., "Simulated Weakness."

over their bodily actions. Included here are the mutually related concepts of the sense of self-agency and motor intention, as well as attention.[23]

The third type entails concepts of traumatic memories and emotion processing. We will examine how researchers have used these two action-guiding concepts to search for neural mechanisms that could explain the potential role of emotions in the formation and maintenance of various hysterical symptoms.[24] Finally, the fourth type incorporates resting-state functional connectivity and functional plasticity, two concepts used in cognitive neuroscience to investigate the intrinsic dynamic properties of the human brain. The concept of resting-state functional connectivity has enabled researchers to look for distinct pathological changes in spatial and temporal patterns of spontaneous brain activity when hysteria patients are not engaged in external tasks.[25] Conversely, the concept of functional plasticity is rooted in the assumption that the brain's neural circuitry undergoes modifications in response to experience.[26] We will see that by implementing the concept of neuroplasticity, researchers aim to correlate the therapy-induced longitudinal evolution of different hysterical symptoms with measurable changes in brain activity and connectivity patterns.[27]

Even at a cursory glance, it is apparent that the action-guiding concepts listed above are highly heterogeneous. Some of these concepts, such as hypnosis, malingering, traumatic memories, and attention, may already seem familiar to us from Charcot's, Janet's, and Freud's hysteria research, although, as we will see, their respective meanings have shifted considerably in the current context.[28] By contrast, resting-state functional connectivity and the sense of self-agency are relatively novel neurobiological concepts developed in the context of neuroscientific research into human cognitive processes.[29] Furthermore, as will become evident in the course of my analysis, there are considerable differences among these concepts, not just regarding their particular referential contents but also the specificity with which they are defined. Hence, on a superficial view, this diversity of partly revived and partly newly adopted concepts may appear inconsistent. However, in this chapter, I will claim that precisely the diversity of these concepts pertinently reflects the exploratory character of the current fMRI hysteria research. We will see that this parallel use of multiple action-guiding concepts allows researchers to experimentally test a wide variety of provisional assumptions about the still unknown neurophysiological basis of heterogeneous hysterical symptoms.

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23 See, e.g., Mailis-Gagnon et al., "Somatosensory Processing"; Nahab et al., "Sense of Agency"; Voon et al. "Involuntary Nature"; and Voon et al., "Limbic Activity."

24 See, e.g., Aybek et al., "Life Event"; Espay et al., "Functional Tremor"; Kanaan et al., "Repressed Memories"; and Morris et al., "Avoidance."

25 See, e.g., Otti et al., "Somatoform Pain"; van der Kruijs et al., "Resting-State Networks"; and Wei et al., "Abnormal Default-Mode Network."

26 See Berlucchi and Buchtel, "Neuronal Plasticity," 307.

27 See, e.g., Dogonowski et al., "Recovery"; and LaFaver et al., "Before and After."

28 For details on Charcot's, Janet's, and Freud's uses of these concepts, see chapters 1 and 2.

29 For resting-state connectivity, see, e.g., Raichle, "Brain's Dark Energy." For the sense of self-agency as a neurological concept, see, e.g., Chambron, Sidarus and Haggard, "Sense of Agency."

It should be emphasised that my analysis will not be limited to providing a detailed overview of the action-guiding concepts that dominated the fMRI-based exploratory investigation of hysteria in the first two decades of the twenty-first century. Rather, my primary aim is to analyse what Steinle has called "the constant give-and-take between experimental activity and conceptualization" as a two-way process.[30] To be more precise, I will argue that the interaction between fMRI maps, on the one hand, and the action-guiding concepts that partake in their production and interpretation, on the other hand, is highly dynamic and by no means unidirectional. We will see that images—i.e., fMRI maps—are not deployed as passive conduits that merely impose predefined external concepts onto hysteria. Instead, I intend to show that the procedural logic of an fMRI experiment substantially reframes both the preliminary, initially adopted meanings of each action-guiding concept and its relation to hysteria. To achieve this goal, I will once again deploy Ludwig Jäger's notion of transcriptivity, defined as a medium-specific process of semiosis.[31] Specifically, I will argue that, in the neurobiological hysteria research, the relationship between hysteria and the action-guiding concepts is mediated through the process of generating, reading, and interpreting fMRI maps. For this reason, my discussion will disregard the iconographic aspects of these images. As in the previous chapters, I will continue to focus on examining pertinent aspects of how images are produced and interpreted.

In each of this chapter's following eight sections, I will analyse how the heterogeneous action-guiding concepts listed above have been transcribed and renegotiated through the process of their experimental testing across different fMRI studies. Through a comparative analysis of exemplary case studies, I will trace the different ways in which each action-guiding concept has been experimentally framed, depending on the network of semantic references set up by a particular fMRI experiment. Significantly, I will argue that the different semantic transcriptions, which have taken place across individual experiments, are far from arbitrary. We will see, instead, that each new transcription is informed by references to both findings and shortcomings of previous fMRI studies, which had deployed the same action-guiding concept. Hence, my analysis will demonstrate that the discursive, dynamic, and open-ended experimental testing and the consequent revision of the provisional action-guiding concepts across multiple studies is what makes the current fMRI hysteria research potentially epistemically productive. Even more to the point, I will show that this parallel and iterative fMRI-based transcription of multiple concepts enables the ongoing research to define its epistemic object—the hysteria patients' aberrant brain function—with growing precision. My analysis is aligned with Steinle's claim that, in exploratory experimentation, "it is chains, series, or networks of experiments that lead to conclusions."[32]

By the end of the chapter, it should become apparent that the diverse action-guiding concepts at the centre of our discussion have undergone very different processes of revision through the respective chains of fMRI experiments. Thus, we will see

30 Steinle, *Exploratory Experiments*, 6.

31 Jäger, "Transcriptivity Matters," 49.

32 Steinle, *Exploratory Experiments*, 331.

that some of these action-guiding concepts have become increasingly refined across multiple studies, whereas others proved difficult to operationalise experimentally. I will also foreground that a few of these concepts have followed a wayward trajectory of fluctuating epistemic efficacy concerning hysteria. Let us now examine the details of this process and the epistemic effects it has generated in the first two decades of the twenty-first century.

4.1 Examining Hysteria's Relationship to Malingering and Hypnosis

Throughout this enquiry, we have seen that at various points of its history, in clinical and research contexts, hysteria has been repeatedly compared to both feigning and hypnosis. This ongoing comparative investigation has been rooted in the fact that, based on observation alone, hysterical symptoms are "behaviourally indistinguishable" from both their intentionally simulated and hypnotically induced counterparts.[33] We have discussed how this inability to reliably distinguish hysteria from intentional simulation has been perennially framed in negative terms as a hindrance to an accurate diagnosis. Also, we have analysed how Charcot explicitly attempted to tackle this problem by using visualisations of breathing curves as a clinical tool for differentiating between genuine patients and simulators.[34] Just as importantly, I have shown that Charcot drew on the visual similarities between hysterical and hypnotically induced physical symptoms in favourable terms as an epistemic justification for his use of hypnosis to experimentally model hysteria. We are also familiar with the fact that Charcot's use of hypnosis was, at the time, severely criticised by Bernheim but defended by Janet.[35]

If we take into account this long history of their mutual comparison, it is unsurprising that, from the very start, both malingering (i.e., intentional feigning) and hypnosis have played important roles in informing the functional neuroimaging investigation of hysteria.[36] What is equally unsurprising is that this research strand has focused on the symptom of hysterical limb paralysis. This is because, as already demonstrated by Charcot, the behavioural similarities between genuine hysterical and either hypnotically induced or intentionally feigned limb paralysis are particularly easy

33 Ward et al., "Differential Brain Activations," 310.

34 See section 1.2.2.

35 For Charcot's use of hypnosis to model hysterical symptoms, see sections 1.2, 1.2.1, 1.2.2, and 1.3.2. For Bernheim's criticism and Janet's defence of Charcot's approach to hypnosis, see sections 2.1.1 and 2.1.2, respectively.

36 See Ward et al., "Differential Brain Activations"; Halligan et al., "Hypnotic Paralysis"; Spence et al., "Disorder of Movement"; and Stone et al., "Simulated Weakness." As discussed in section 2.2.3, the *DSM-III* introduced a distinction between two types of feigning, which has been retained ever since. Malingering was defined as the intentional feigning performed by an essentially healthy subject. By contrast, factitious disorder was designated as a psychiatric condition arising from an unconscious psychological need to assume the sick role through feigning. See APA, *DSM-III*, 285. The former type of feigning—i.e., malingering—plays a role in fMRI hysteria research. In line with the current neuroimaging literature, in the remainder of this chapter, I will use the terms malingering and feigning interchangeably to refer exclusively to the intentional fabrication of hysterical symptoms by healthy subjects.