Glossary

action-guiding concept is a term introduced by Friedrich Steinle in his discussion of exploratory experiments. See exploratory experimentation.

activation is a term used in task-based fMRI studies to designate task-induced local changes in brain activity detected by contrasting two or more experimental conditions or by comparing a specifically designed task to a control 'baseline' state. See contrast, design matrix, and functional activation map.

active/inactive voxels are constitutive parts of an fMRI map. Generally speaking, voxels are elementary spatial units of any three-dimensional digital image (i.e., 3D equivalents of pixels). In an fMRI map, those voxels in which, after hypothesis testing, the probability that the response to experimental stimulation was due to chance was determined to be below a predefined significance threshold are declared active. All other voxels in the fMRI map are declared inactive. When the map is visualised, only the active voxels are made visible. See functional activation map and inferential statistics.

articulation is a term introduced by Bruno Latour to designate the gradual experimental process through which scientists bring different phenomena in relation to one another in order to identify their mutual differences and thus obtain new, unexpected scientific insights (see Latour, *Pandora's Hope*).

associationism is a theory of mental processes whose proponents were influential eighteenth- and nineteenth-century philosophers, physicians, physiologists, and neurologists, such as David Hume, David Hartley, Alexander Bain, Herbert Spencer, William Carpenter, Théodule Ribot, David Ferrier, and Jean-Martin Charcot. The theory's basic tenet was that the phenomenon designated as the association of ideas represented the fundamental principle, which governed the working of the human mind. In this view, sensory impressions of external stimuli first produced sensations in the mind, which, in turn, gave rise to simple ideas. A simple idea was merely a copy or a memory of the sensation. Such simple ideas then merged through the process of association into complex ideas. Once the associative links were established

between two or more ideas, these ideas became inseparable—the activation of one idea inevitably led to the activation of all the associated ideas. Many proponents of associationism regarded the association of ideas to be a physiological process that took place in specialised brain centres.

contrast is a term that has two different meanings in neuroimaging. On the one hand, it refers to a particular physical quantity whose varying intensity values are spatially encoded in an MRI/fMRI image. For example, neuroscientists designate different types of imaging data by talking about T_1, T_2, and T_2* contrasts. On the other hand, during statistical analysis of fMRI data in task-based experiments, a statistical comparison of effects induced by two or more different experimental conditions is also referred to as contrast.

cerebral automatism is a term introduced by the nineteenth-century English physiologist William Carpenter to designate purely automatic ways in which higher-order brain centres respond to external stimuli through a process of involuntary association of ideas (see Carpenter, *Mental Physiology*). Carpenter also referred to this process as unconscious cerebration. See associationism.

cerebral localisation is a nineteenth-century paradigm according to which the brain does not represent a single, homogeneous organ but consists of specialised centres, each of which controls a particular physiological or cognitive function. See functional brain lesion.

conversion is a term introduced by Sigmund Freud to designate the hypothetical psychological process through which the repressed negatively-charged emotional content was transformed into a chronic somatic symptom (see Freud, "Neuro-Psychoses of Defence"). Freud viewed conversion as the fundamental pathological characteristic of hysteria.

default-mode network (DMN) is a concept introduced in the context of resting-state fMRI research. It designates the set of interconnected brain regions whose activity is high while the subject rests but decreases during the active performance of sensorimotor and cognitive tasks. See resting-state fMRI.

descriptive statistics are used to summarise a particular dataset through two basic measures: measures of central tendency and measures of variability. None of these measures can be used to make inferences about a larger population. See inferential statistics.

design matrix is the concrete implementation of the general linear model (GLM) in the context of a particular fMRI study. By constructing the design matrix, researchers make assumptions about how the experimental conditions of interest and various nuisance factors have influenced their fMRI data throughout the experiment. See general linear model.

dissociation is a concept introduced by Pierre Janet to designate a fundamentally pathological fragmentation of the otherwise integrated mental functions and contents in individuals with a hereditary predisposition (see Janet, *Major Symptoms*). Once dissociated, the mental functions and contents were no longer accessible to the individual's consciousness. According to Janet, dissociation was the psychological mechanism that underpinned the formation of all hysterical symptoms. See fixed idea.

DSM is the acronym of the *Diagnostic and Statistical Manual of Mental Disorders*. The *DSM* is the dominant classification system and diagnostic tool in present-day clinical and research psychiatry, published by the American Psychiatric Association (APA). Since it first appeared in 1952, the *DSM* has undergone multiple periodical updates. The manual's current version, the *DSM-5*, was published in 2013. In March 2022, the APA published a revision of the *DSM-5*, titled *DSM-5-TR* (the acronym TR stands for 'text revision'). See nosologic.

EPI stands for echo-planar imaging, the standard method of acquiring fMRI images in contemporary MRI scanners. Due to a particular sampling sequence developed by the British physicist Peter Mansfield, all data points required to reconstruct an entire 2D fMRI slice can be acquired within a fraction of a second. See fMRI/MRI imaging data.

exploratory experimentation is a concept introduced by Friedrich Steinle to designate scientific experiments that are not aimed at testing pre-established high-level theories but focus instead on identifying previously unknown empirical regularities through systematic variation of different experimental parameters (see Steinle, *Exploratory Experiments*). Although not theory-driven, exploratory experiments are heuristically organised around what Steinle refers to as action-guiding concepts. These are operational, more or less clearly defined preliminary assumptions and empirical notions about the phenomenon under study, which serve to organise targeted variations across multiple arrangements of experimental parameters. During the exploratory experimentation, such action-guiding concepts are tested, revised, discarded or stabilised.

false positives/false negatives are types of errors that unavoidably emerge during statistical hypothesis testing, which underpins the analysis of fMRI data. False positives are inactive brain voxels that were falsely declared active. Conversely, false negatives are active voxels that were falsely declared inactive. See active/inactive voxels and inferential statistics.

fixed idea (idée fixe) is a concept whose multiple semantic shifts in the medical context throughout the nineteenth century are analysed in this book. Most medical authors considered the fixed idea to be a pathological mental content. Conversely, William Carpenter contended that fixed ideas could also occur in healthy individuals and were especially prevalent during hypnosis (see Carpenter, *Mental Physiology*). Some claimed that fixed ideas were conscious, whereas others insisted that they were entirely unconscious. Jean-Martin Charcot and Pierre Janet argued that fixed ideas underpinned

the formation of hysterical symptoms. But Charcot defined fixed ideas in strictly physiological terms as morbidly intense nervous currents that led to the creation of functional brain lesions (see Charcot, *Diseases of the Nervous System*, vol. 3). By contrast, Janet viewed fixed ideas in purely psychological terms as pathologically dissociated mental contents (see Janet, *Mental State*). See dissociation and functional brain lesion.

fMRI is the acronym of functional magnetic resonance imaging, a non-invasive neuroimaging technology that has been used since the early 1990s to indirectly measure and anatomically map brain function in living human subjects. Functional magnetic resonance imaging was derived from the older magnetic resonance imaging (MRI), a technology used for in vivo measurement and visualisation of anatomical structures. By allowing the measurement of localised regional neural activity and neural connectivity, fMRI enables neuroscientists to make inferences about how the human brain works. The most commonly used fMRI method is the blood-oxygenation-level dependent (BOLD) contrast.

fMRI/MRI imaging data (also fMRI/MRI images or scans) are direct outputs of the measurement procedure performed by an MRI scanner. MRI images provide information about the structural features of the brain measured. Conversely, fMRI imaging data contain indirect information about the neural activity of interest. Since they are illegible, fMRI imaging data have to be transformed into functional brain maps through statistical analysis. See legible/illegible images, functional activation maps, and functional connectivity maps.

Fourier transform is a mathematical method developed by the nineteenth-century French physicist and mathematician Joseph Fourier. Owing to this method, any complex signal can be described as a weighted sum of simple waves of various wavelengths and amplitudes. This method provides the basis for the automated algorithm, the *fast Fourier transform*, which underpins the production of images from the sampled signals during functional and structural MRI imaging. See fMRI/MRI imaging data and k-space.

functional activation map is a parametric map derived from statistical analysis of fMRI data stemming from a task-based study. It is a spatially organised collection of voxels containing the outcomes of statistical tests performed separately on each voxel to evaluate the probability that the experimental effect at that voxel was due to chance. An activation map does not provide information about the neural activity of interest in absolute terms. It also does not contain any information about brain anatomy. When visualised, fMRI maps are overlaid on images that display brain anatomy. See general linear model, inferential statistics, and SPM.

functional brain lesion is a concept introduced by Jean-Martin Charcot in the framework of his hysteria research. According to Charcot, heterogeneous hysterical symptoms were all caused by some localised and potentially reversible brain dysfunction that, depending on the type of the symptom, affected different cerebral centres (see Charcot, *Diseases of the Nervous System*, vol. 3). See cerebral localisation and fixed idea.

functional connectivity map is a type of statistical map computed from fMRI data. It provides information about the spatial distribution of brain networks—widespread brain regions whose either spontaneous or task-induced activities are mutually temporally correlated. Functional connectivity maps thus provide information about the brain's connectivity patterns, either during rest or during the performance of an experimental task. See PPI and resting-state fMRI.

functional neurological disorders (FND) is a newer and increasingly dominant present-day medical designation for symptoms previously grouped under the now-discarded label of hysteria. Alternative medical designations still used in the medical context include conversion disorder, somatic symptom disorder, psychogenic symptoms, and dissociative neurological symptom disorder. See hysteria.

general linear model (GLM) is a technique that underpins most statistical data analyses in task-based fMRI experiments. This model assumes that all factors contributing to the neural activity measured in a particular voxel linearly add up to form an overall BOLD response. See design matrix and haemodynamic response.

graphic method is the term introduced by the nineteenth-century physiologist Étienne-Jules Marey to denote the systematic use of different mechanical instruments, many of which were invented by Marey, to decompose and analyse various aspects of the human and animal movement by translating them into graphic inscriptions such as curves (see Marey, *Méthode graphique*).

haemodynamic response (HDR) is a temporally extended neurophysiological effect that the BOLD fMRI method measures as a proxy for the correlated neural activity of interest. Unlike the neural activity, which lasts only a fraction of a second, the haemodynamic or BOLD response lasts 12–20 seconds and has a distinct temporal development that can be modelled by a curve with a particular shape. The haemodynamic response results from interrelated metabolic and vascular processes that take place in the vicinity of active neurons. See fMRI and general linear model.

hysteria is, in this book, a designation used as a shorthand for a collection of highly heterogeneous and baffling somatic symptoms, which were once at the centre of Jean-Martin Charcot's neurological research and have in the first two decades of the twenty-first century become the focus of the systematic fMRI-based investigation. Although officially expunged from the medical nosology, the term hysteria is retained in this book to emphasise that the current fMRI research is informed by the underlying idea that the clinical characteristics of symptoms previously referred to as hysterical have remained unchanged since the nineteenth century. This book does not treat hysteria as a transhistorical disease entity but instead analyses shifting medical attitudes and conceptualisations of symptoms that include limb paralysis, anaesthesia, visual disturbances, pseudoepileptic seizures, speech loss, and contractures. See functional neurological disorder.

image operativity is a concept recently developed across various strands of media theory and visual studies to foreground that, instead of being passive displays of visual information, images are active instruments that constitutively shape the events in which they partake. There are multiple approaches to image operativity in the current scholarship. This book draws on Sybille Krämer's approach, which she developed by focusing on the knowledge-producing potential of images when used operatively. According to Krämer, to be employed in epistemically productive ways, operative images require their users to actively engage with them (see Krämer, "Operative Bildlichkeit").

indexicality is, in this book, used in the sense defined by Ludwig Jäger. According to Jäger, to be instituted as an indexical sign, a trace of a causal, physical contact with an object must undergo a medium-specific process of interpretation, which embeds this trace into a network of references to other signs and inscriptions (see Jäger, "Indexikalität und Evidenz"). Defined in this way, indexicality is not simply a direct consequence of the physical contact between the object and the sign, as it requires to be constituted through the subsequent process of semantic articulation.

inferential statistics permit researchers to use datasets from their subject sample to make claims about a larger population. Inferential statistics used during fMRI data analysis are based on the process called hypothesis testing. Generally speaking, this type of statistical analysis starts with the formulation of two opposing claims: the null hypothesis and the alternative hypothesis. In fMRI, the null hypothesis entails the proposition that the experimental manipulation had no effect on the data. The alternative hypothesis entails the opposite claim. In the next step, various statistical tests (e.g., t-test, F-test, ANOVA) can be used to evaluate which of the two hypotheses describes the data with a higher probability. See active/inactive voxels.

intramedial and intermedial references are targeted products of transcriptive operations. See transcriptivity.

k-space is a way of collecting, organising and storing signals measurements (i.e., raw MRI data) so that the standard mathematical reconstruction algorithm called the *inverse Fourier transform* can translate them, without any information loss, into a 2D structural or functional MRI image. At a more abstract level, k-space is also a mathematical framework that informs the entire data acquisition to allow an optimal translation of the brain's properties of interest into images with desired characteristics. See Fourier transform.

legible/illegible image is a pair of terms introduced in this book to differentiate the extent to which the information of interest, which had been encoded into operative images during their production, can be accessed through visual inspection of these images. In illegible images, the information of interest is not directly accessible to their users because the images' visual content is unclear and cannot be made out. In other words, illegible images are impossible to read. By contrast, in legible images, the information of interest is accessible to visual inspection. Thus, in this book, legibility

designates a property of an image, i.e., whether or not an image is visually opaque. See readable/unreadable images.

multiple comparisons problem refers to an increase of false-positive voxels in an fMRI activation map due to voxelwise data analysis that entails conducting many thousands of statistical tests. In fMRI, various methods are used for countering this problem by calculating a corrected significance threshold value and thus minimising the rates of false-positive voxels. See false positives/false negatives and inferential statistics.

neurosis is an equivocal term whose historically changing meanings are thematised in this book. As used by Jean-Martin Charcot, neurosis was an umbrella term to designate various neurological disorders for which, at the time, no apparent organic cause could be found. Charcot's former pupil Sigmund Freud later redefined neuroses in purely psychological terms, as disorders caused by repressed, emotionally charged memories.

noise is, in this book, understood as a highly relational term. Generally speaking, the term denotes any non-meaningful changes of some measured quantity in the experimental system. But what counts as noise, even in the same dataset, depends on how researchers choose to analyse and interpret their data.

normalisation has two different meanings in this book. On the one hand, it denotes the re-establishment of a previously impaired physiological function or normal neural activity after a successful therapeutic intervention. On the other hand, it designates a particular preprocessing step that prepares fMRI data for statistical analysis. During this step, individual subjects' fMRI data are mathematically transformed into a standard space. See standard space.

nosographic is a term denoting the first stage of Jean-Martin Charcot's clinico-anatomical method. During this stage, Charcot focused on establishing a detailed description of a disorder's salient clinical features, which he jointly designated as a pathological type. The nosographic stage thus served to define a disorder' previously unknown type. In the subsequent stage of his clinico-anatomical method, Charcot then correlated the disorder's clinical features to findings obtained through the post-mortem analysis of his deceased patients' central nervous system.

nosologic is an adjective. It means pertaining to the official classification systems of diseases in the present-day medicine and psychiatry. See *DSM*.

parametric map is another name for an fMRI activation map. See functional activation map and SPM.

perimetric map is a schematic diagram that visualises the size and spatial distribution of an individual's visual field by charting the extent of their peripheral vision in multiple directions.

PPI is the acronym of the psychophysiological interaction, an analysis method widely used for computing functional connectivity maps in task-based fMRI experiments. See functional connectivity map and SPM.

raw imaging data are, in this book, understood in purely relational terms as fMRI data that are a direct output of the measurement and have yet to undergo subsequent algorithmic procedures, such as preprocessing and statistical analysis. In this context, the designation 'raw' does not imply that the data in question offer any unmediated access to the brain activity of interest. In fact, a significant portion of this book focuses on discussing complex media-specific operations that underpin the production of raw data.

readable/unreadable image is a pair of terms introduced in this book to foreground the interactive relations between an operative image and its informed user. Unlike the related pair of terms legible/illegible, which emphasises the image's innate visual properties, the terms readable/unreadable shift the focus to the visual skills of the user. In this book, a legible image is designated as readable only in relation to those users who have the visual expertise required to read a particular image in an informed way. Thus whereas an illegible image is impossible to read for anyone, a legible image can be readable for some and, at the same time, unreadable for others. See legible/illegible and reading vs. interpretation.

reading vs. interpretation is a distinction of terms introduced in this book to enable the analytical differentiation between two specific ways in which researchers interact with operative images during the working process. Drawing on Sybille Krämer, in this book, reading is defined as a process through which experts extract the information of interest from purposefully construed images by knowing on which visual features to focus as salient and which visual details to ignore as accidental (see Krämer, "Operative Bildlichkeit"). The selective seeing that underpins reading is not arbitrary. Instead, it is grounded in the set of assumptions and conventions that are shared by a particular community of researchers at a given moment. Hence, how to read images in a particular context must be learnt. As defined in this book, interpretation is a subsequent operation through which researchers attribute operative, symbolic meanings to the information they have obtained by reading the images. See readable/unreadable image.

referential chain is a term introduced by Bruno Latour. It designates long cascades of successive intermediary operations, targeted manipulations, and transformations through which scientists gradually translate an object of interest into a scientific image, which they can then use to make judgments about that object (see Latour, *Pandora's Hope*). The referential quality of the resulting scientific image hinges on the consistency of the underlying chain of transformation that produced the image.

resting-state fMRI is rooted in the fMRI-based discovery that even when the subject is not explicitly engaged in a cognitive task, various brain areas nevertheless exhibit spontaneous, mutually coordinated activities. Consequently, in resting-state fMRI

studies, the subject is not required to perform an explicit task but instead instructed to lie still and rest inside an MRI scanner. The thus obtained fMRI data are then submitted to different functional connectivity analyses to identify correlated patterns of intrinsic brain activities that provide insights into the brain's inherent functional networks. See default-mode network and functional connectivity map.

reverse inference is the interpretative operation commonly used in neuroimaging, which entails making assumptions about the involvement of specific cognitive processes based on the activation and connectivity patterns obtained in functional fMRI maps.

SPM is the acronym of Statistical Parametric Mapping, the open-source software package widely used in the neuroimaging community for statistical analysis of fMRI data, as well as other functional neuroimaging modalities. Originally developed by Karl Friston in the early 1990s, it remains one of the most popular tools for fMRI analysis and is regularly being updated by the Wellcome Centre of Human Neuroimaging in London. Its current version is the SPM12. A highly flexible analysis package, the SPM can be used to compute both functional activation and functional connectivity maps. It requires the MATLAB programming environment to run on a computer. See inferential statistics, functional activation map, functional connectivity map, and parametric map.

standard space is a concept that underpins the process of normalisation in fMRI studies. It refers to a common referential 3D coordinate space that facilitates the alignment of individual subjects' brains within a group study and the comparison of results across different studies. The coordinates of the standard space are derived from one of the brain atlases. The currently most widely used standard space in fMRI is the MNI space developed by the Montreal Neurological Institute. See normalisation.

suggestion is an equivocal term whose divergent meanings for different hysteria and hypnosis researchers from the late nineteenth century onwards are discussed in this book. Overall, suggestion is understood to designate the introduction of an idea into the mind of another subject. Yet there is little agreement among researchers discussed in this book on whether suggestion is a normal or a pathological process, how it transpires in the mind and translates into observable physical effects, and whether its underlying mechanism is primarily physiological or psychological.

transcriptivity is a concept introduced by Ludwig Jäger to foreground the operative and procedural aspects of meaning production across all communicative media, such as speech, writing, analogue, and digital images (See Jäger, "Transcriptivity Matters"). According to Jäger, the ascription of meaning is a dynamic process organised through operations that entail a targeted production of intramedial and intermedial relations across different signs. Whereas intramedial operations interconnect signs within a single medium (e.g., relating images to other images), intermedial operations establish mutual references across different media (e.g., relating images to texts).

trauma is a concept whose historically shifting meanings in the medical context are traced in this book. These range from the initial meaning as a surgical wound, over a more general interpretation as a physical impact of some external force on the body that may or may not result in an injury, to a purely psychological understanding of trauma as any event that subjectively affects an individual in emotionally damaging ways.

wet collodion process is a photographic technique used in the late 1870s by the doctors working under the auspice of Jean-Martin Charcot at the Parisian hospital Salpêtrière to explore and identify salient features of the hysterical attack, the most dramatic, paroxysmal symptom of hysteria. The wet collodion process was invented by Frederick Scott Archer in 1851. The technique produced a negative image on a glass plate, which could then be used to print multiple paper copies.