The Felt Presence experience: From cognition to the clinic

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Keywords

Felt Presence; Sensed Presence; Hallucinations; Psychosis; Religion; Social Agent Representation; Body Schema; Sensory Integration; Corporeal Awareness

Summary

The Felt Presence (FP) experience is the basic feeling that someone else is present in the immediate environment, without a clear sensory evidence. Ranging from benevolent to distressing, personified to ambiguous, FP has been observed in neurological case studies, within psychosis and paranoia, associated with sleep paralysis and anxiety, and recorded within endurance sports and spiritualist communities. In this review we summarise the philosophical and phenomenological, clinical and non-clinical correlates of FP, as well as current approaches using psychometric, cognitive, and neurophysiological methods. We present current mechanistic explanations for FP, suggest a unifying cognitive framework for the phenomenon, and discuss outstanding questions for the field. FP offers a sublime window of opportunity to understand the cognitive neuroscience of own-body awareness and social agency detection; an intuitive, but poorly understood experience in health and disorder.

Introduction

> *'Instantly I felt a shock running through all my frame; nothing was to be seen, and nothing was to be heard; but a supernatural hand seemed placed in mine… the nameless, unimaginable, silent form or phantom, to which the hand belonged, seemed closely seated by my bed-side… I knew not how this consciousness at last glided away from me…'* **(Moby Dick, Herman Melville)**

Felt presence (FP) experiences are the basic feeling that someone else is present in the immediate environment without any other clear sensory evidence [1-3]. It has been argued that FP is an "imperfectly developed" hallucination in which "the person affected will feel a 'presence' in the room, definitely localized, facing in one particular way, real in the most emphatic sense of the word…and yet neither seen, heard, touched, nor cognized in any of the usual 'sensible' ways" [3]. FPs are differentiable from visual, tactile, auditory, vestibular and coenesthetic hallucinations and from visual forms of autoscopic phenomena [4-5]. Nevertheless, FP experiences may regularly precede or follow other forms of hallucination (e.g., auditory verbal hallucinations), and in some instances a FP may be identifiable as the same social agent that personifies other sensory hallucinations [6] and autoscopic experiences [7].

Recent work in hallucination research has estimated that as many as half of individuals seeking treatment for psychosis may experience FP [8]. Importantly, FP has been recently highlighted by "Psychosis Outside the Box" (POTB), a grassroots project aimed at collating first-person accounts of underrepresented experiences in psychosis [9]. Along with FP, the first POTB report includes accounts of visions and quasi-visual experiences, alterations of time and space, and coping strategies. While some of the FP accounts describe sleep-related phenomena, others are like classic reports of presence, e.g. "I have felt the presences of human-like entities near me…It was as real as seeing a person in front of me, but without the visual." [9]. Some also noted that a typical clinical focus on voices or paranoia often missed the underlying FP and meaning-making process that surrounds the FP experience. However, similar to other forms of hallucination, FPs are not limited to those seeking psychiatric support. FPs have been recorded in the general population [10], those participating in mountaineering expeditions [11], during bereavement [12], near death [13], in hypnagogic states during sleep paralysis [14], in the context of intense religious experiences [15], and as a corollary of neurological disorders such as Parkinson's disease [16-17], stroke [18], or seizure disorders [19]. Despite its prevalence in the clinic and beyond, FP remains relatively unknown and poorly understood.

In this review, we cover the historical and recent advances in our understanding of FP. We first discuss the phenomenology of the experience. Next, we cover psychometric and qualitative techniques used to record such experiences, and the clinical and non-clinical associations with FP. Finally, we consider mechanistic explanations based on the experimental induction of FP and related phenomena. For a definition of technical terms used in this manuscript, please see our Glossary (Table S3). We propose that recent advances in formal and descriptive theory offer a chance at a unified account to

explain the causal origins of FP, but also of other forms of hallucinations, whether basic, complex, or personified.

Philosophy and Phenomenology of FP

The ineffable nature of FP warrants care in how it is approached and conceptualized. The large variation in terms that are used to name and describe the FP experience (see Supplementary Materials; Table 1; [20]) illustrates the heterogeneity of the contexts in which it appears. In other fields, 'presence' itself can refer to the feeling of one's own connection to external reality (or "sense *of* presence"; [21]), the full and active immersion in virtual environments [22] that focus on the self-experience of being present and localised in space, or the basic recognition that perceived objects are present in our environment rather than just their image (perceptual presence; [23]). In this review we do not use 'presence' as it is defined in virtual reality (VR), aesthetic, and phenomenological literature. Here, we focus on 'presence' specifically as a basic sense or feeling of another person, agent, or identity – which is arguably more common in clinical descriptions.

The phenomenology of FP is heterogeneous, yet the emergence of the experience involves a universal interruption in the 'common-sense' of 'everydayness'. Importantly, FP can be described by those who experience it first-hand [24]: Jaspers [25] described FP experiences (*leibhaftige Bewusstheiten*) in a clinical population as "patients who have a certain feeling (in the mental sense) or awareness that someone is close by, behind them or above them, someone that they can in no way actually perceive with the external senses, yet whose actual/concrete presence is directly and clearly experienced" [2,26]. Common-sense (*ein sehr Selbstverständliches*), as introduced by Husserl, is the background milieu or environment which consists of "something taken for granted" as well as "something entirely commonplace." It creates a fabric of combined senses that cohesively weave together the interior and exterior world that is "centered around the 'presentness' of the world that remains as elusive as it stands plainly there in all its obviousness" [27]. Blankenburg expands the parameters of common-sense to include not only the self but also the social and cultural contextual lifeworld of everydayness [28].

The degree of personification, frequency, vividness, level of distress, and meaning attributed to the FP can vary given the individual, social, and cultural context of the experience (see Table 1; Figure 1). For example, FP in the context of a religious experience is often sought after, comforting, and usually accepted within religious communities [15]. However, FP can also be experienced as distressing and malevolent. William James [3] describes FP as being affiliated with a "horribly unpleasant" sensation that "stirred something more at the roots of my being than any ordinary perception." FPs experienced during hypnagogic and hypnopompic hallucination states often elicit a distressing response to the threatening nature of the experience [29] and are overwhelmingly reported to be external to the individual, rather than being located "in the head" [30].

FP in psychosis is relatively underexplored beyond early case reports. Initial data suggests FPs are often described as inducing fear by those with psychiatric diagnoses [31]. Individuals with ultra-high risk of developing psychosis are more likely to experience an increased frequency and vividness of FP accompanied by increased distress [32]. Within qualitative reports, FP in psychosis may or may not take up a clear position in space and may be linked to an underlying identity, for example, a prior perpetrator of abuse or neglect [11]. Nevertheless FP in psychosis can also be ambiguous and ethereal, described as the presence of an 'external threat' that is near the experiencer but does not take a specific form [32]. In contrast, FPs in Parkinson's disease are marked by often being affectively neutral, having specific spatial position, but lacking in identity [16-17]. Reports from those with focal epileptic seizures place presences as identifiable, locatable, and often with their own intentional motivations [33], whereas those with brain lesions report a 'vagueness' of the phenomenon [4].

Spiritual and ecstatic FPs are often associated with neurological conditions (such as epilepsy or brain tumour [19]), with phenomenology that overlaps with FP in religious contexts or mystical experiences. This includes deep meditative states, in which the FP encounter is the desired outcome [34-36]. In modern culture, individuals known as Tulpamancers actively engage in meditative practices to intentionally create a Tulpa that is experienced as a FP with a quasi-agentive nature, that over time and practice may become an interactive agent [37-38]. Similarly, the use of the psychedelic Ayahuasca [39-40] can induce powerful, emotionally salient, mystical, and often interactive FPs, that can range in identity from Gods and demons to ancestors and personal social relations (e.g., deceased relative). However, there are important cultural caveats. For instance, FP is central to the traditional Ayahuasca ceremony, during which shamans (i.e., trained experts) consumed the substance to achieve a specific purpose, such as divination, healing, and prognostication, by communicating with spirits [41]. In contrast, pared-down versions of the Ayahuasca ceremony frequented by tourists (i.e., non-experts without training or cultural framework) invite participants themselves to consume Ayahuasca and seek their own meaning from the psychedelic experience, which is typically focused on self-awareness and general spirituality [42]. Both social frames may change the identity, location, and affective responses to FP induced through Ayahuasca use.

FPs are particularly common in bereavement contexts [43]. While often positive and comforting, they can be emotionally ambivalent experiences [44]. Frequent among the "hallucinations of widowhood" [45], spontaneously feeling the presence of a dead spouse is seen as a positive, helpful phenomenon, reported to be related to happy, longer marriages and may serve as a mechanism to manage grief. FPs in bereaved wane over time but may still persist in a significant subgroup at least twelve months after loss of spouse, with positive FP experiences at 12 months associated with more intense grief responses soon after death [46]. More recently, FP has been reported upon interacting with "chatbots" or accessing archival memories of the dead stored in social media accounts; these experiences bring comfort as "continuing bonds" [47].

Table 1. Extracts from surveys and case-studies of Felt Presences in different contexts.

Reference	Example Quote/Extract	Context
Pagdon & Jones, 2020 [9]	*'Pretty much anything and everything that my clinicians describe as "hallucinations" or "delusions" feel to me like they have invisible presences that I can sense… They have a kind of ephemeral reality.'*	Psychosis
Rosen et al., 2022 [32]	*"Often there are changes in room temperature. Sometimes there is a perceived busyness or energetic agitation felt when a presence enters my space."* *"Usually in two forms- 1) the presence/spirit of someone I know who is close to me, a recently passed family member, or someone from my past… 2) non-identifiable energies usually associated with a specific mood, location, or gathering. Happens more often when I'm either alone or out in nature. I sense something near…"*	Mental health survey
Arzy et al., 2006 [48]	*…she again reported the presence of the sitting "person", this time displaced behind her to her right and attempting to interfere with the execution of her task ("He wants to take the card"; "He doesn't want me to read").*	Electrocortical stimulation
Brugger et al., 1996 [4]	*…the patient would suddenly become aware of what she called "'the shadow." This term did not refer to some visual quality of the experience but rather indicated the "vagueness and immateriality" of the phenomenon…"I know that the 'shadow' is always slightly in front of me, about 50 cm to the right. I feel that it is very familiar to me, and I kind of know that it is a 'male' shadow"*	Brain Lesion
Fénelon et al., 2010 [16]	*… the 'presence' was felt beside and/or behind the patient; the patient felt the need to check for a real presence, but insight was preserved in most cases. Even with lost insight, FP in PD patients typically lacked the delusional component characteristic of schizophrenia or other psychotic disorders. When the FP was located beside the patient, there was no predominant side and no association between the side of the presence and the predominant side of PD motor signs*	Parkinson's Disease
Picard, 2010 [33]	*[The patient described]…feeling the presence of several members of her family in the immediate environment… and lasted in total several minutes… She did not see or hear these persons… She "recognized" them as close family members…The latter three persons were walking in her apartment, but only in her left near extrapersonal hemispace… This highly vivid and convincing feeling of presences was described by the patient as deeply pleasant…*	Focal Epileptic Seizure
Steffen & Coyle, 2011 [49]	*'It wasn't a physical thing. I didn't feel anything physically. But I felt it so strongly. I felt him.'*	Bereavement
Luhrmann et al., (2021) [15]	*"This time, I was in my car, I was driving home, and I just felt the presence of God, overwhelming… He must have been resting right on top of me, in my car or whatever. It was so powerful; it*	Religious experience

	was hard for me to drive the car… He was there so intensely, and it was so real"	
Solomonova, 2018 [50]	*'I had a few terrifying experiences a few years ago. I awoke in the middle of the night…There was a terrifying figure looming over me. Almost pressing on me. The best way I could describe it was that it was made of shadows. A deep rumbling or buzzing sound was present. It felt like I was in the presence of evil…'*	Sleep Paralysis
Erowid.com (2012); user 'mindexplorer' [51]	*'I came into direct contact with multiple hyperdimensional entities... I remember one entity had a very strong presence…Many of the spirits would enter my body, and I could feel them…They were far stranger than anything I could have ever imagined to be real. However, I must stress that there are no words adequate in describing them, and most of them were felt, not necessarily seen...'*	Ayahuasca
Reddit.com (2016); anon [52]	*"First, what if feels like to feel a presence. Have you ever seen a friend walk into a room, and then you turned your back on them? You know they are there, despite not seeing them, nor hearing them, nor sensing them physically in any other way. You simply know. It's as if there's a compass in your head pointing towards them, or as if there's some sort of field surrounding you, in which you can simply feel their shape…"*	Tulpas

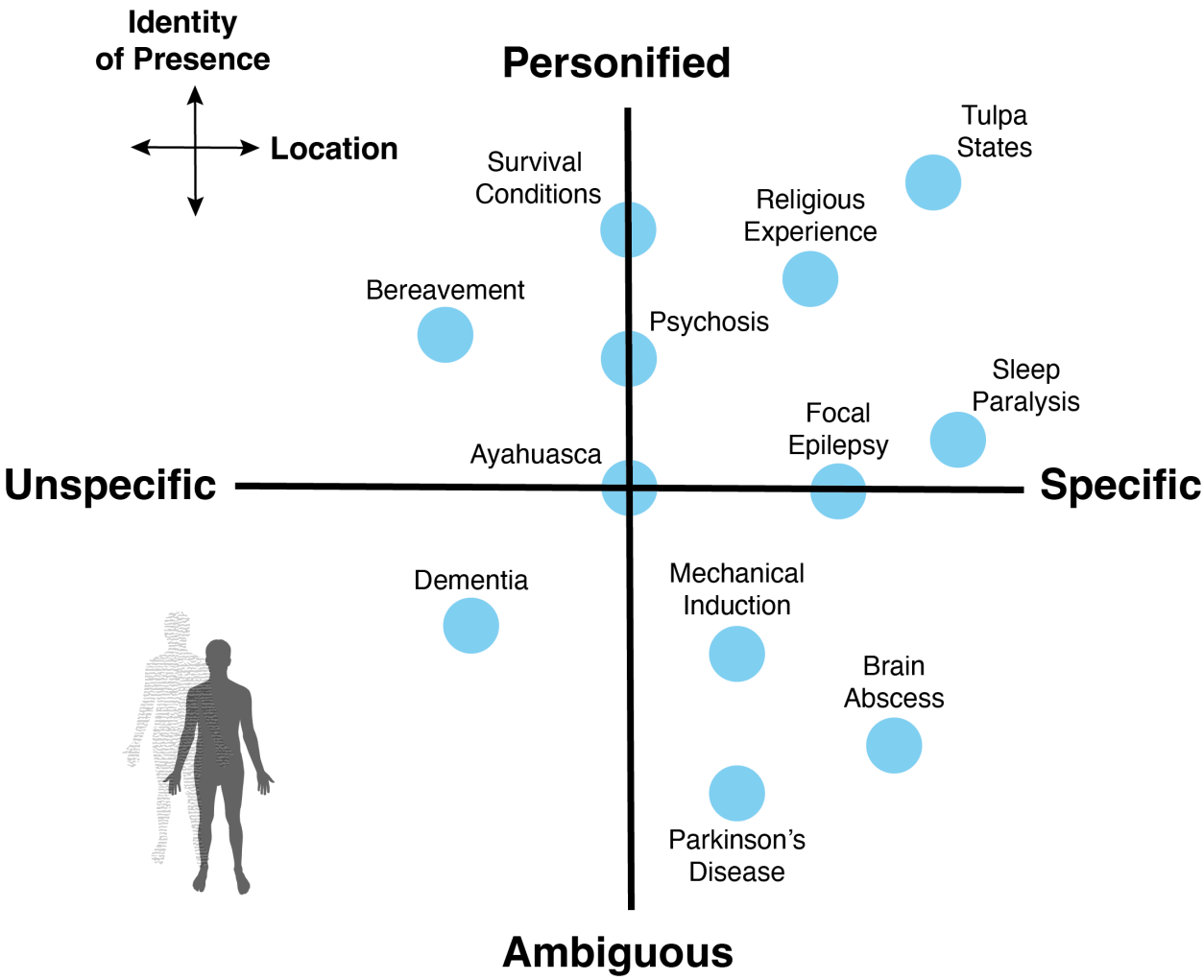

Figure 1. Dimensions which have been attributed to reported Felt Presence experiences. Location refers to the reported spatial specificity of FP in the cited literature – whether they were located at a specific point in space or were vague and ambiguous. Identity refers to whether the FP experience had a defined set of psychological characteristics or not - whether the FP was 'evil', 'curious' or had a specific goal and purpose, or whether the FP had no particular purpose, intention, or set of feelings. Locations of each point in the graph are purely descriptive positions based on the overview of the literature. To note, Ayahuasca experiences involving FP are diverse and involve all the extremes - ecstatically positive, distressingly negative, highly specific in personality, the impression of an ambiguous aura, or located in a variety of space simultaneously. Likewise, FP in psychosis is often personified although can be ambiguous, e.g., in the case of persecutory ideation where a sense of evil presence is dispersed in external space but without a specific identity. Importantly, location and identity of FP can be highly variable over time and within individuals; the identical circle sizes are used for visual brevity and not indicative of the variability within each category.

Measurement

FP can lead to diffuse and idiosyncratic experiences, making them challenging to study empirically [11]. Nevertheless, the frequency and valence of FP phenomena have been captured psychometrically through validated scales that capture psychotic-like experiences or perceptual alterations (Table 2); these include single items within larger scale.

Other validated psychometric scales more comprehensively capture FP in a range of contexts (Table 2). The Multi-Modal Unusual Sensory Experiences Questionnaire [54] includes four items that assess the valence and frequency of FP alongside auditory, visual, olfactory, gustatory, and tactile items. The Sensed Presence Questionnaire [55] is an exclusive measure of FP experiences, comprising neutral, benign, and malign presence items, including themes of stress, location, bereavement, and hypnagogia. In Parkinson's research, the frequency, identity (human/animal), and familiarity of FP experiences are recorded alongside other items probing the severity of Parkinsonian symptoms [56]. In the context of sleep research, the Durham Hypnagogic and Hypnopompic Hallucinations Questionnaire includes specific items on FP [57], as does the Other Experiences Questionnaire, which has been used to assess strength of social imagery, including several items on FP, although also contain themes of paranoia (being watched [12]). Finally, the Index of Core Spiritual Experiences assesses felt presences with spiritual or religious overtones, particularly the presence of God or spiritual figures [58].

Felt presences have also been identified using mixed-method, phenomenological surveys and interviews. For example, using a non-leading, non-hierarchal approach to unusual experiences in first episode psychosis, researchers have used open-ended and close-ended questions to elicit rich descriptions that are amenable to qualitative analysis [6,8]. For hypothesis generation, mixed-method approaches offer a larger space to explore unusual experiences with great phenomenological depth (see Table S2). The value of such approaches is that participants can describe the experience in their own words; given the ineffability of many FP, it's possible that standardised scales will miss key facets of the experience.

Table 2. Overview of psychometric measures that capture Felt Presence experiences. The table is ordered by the number of FP items in each measure. Number of items referring to FP are limited to questions that are unambiguous and do not conflate wording with other forms of sensory hallucination, e.g. visual, auditory, olfactory. *The INSPIRIT questionnaire is specifically directed toward feeling the presence of a God(s).

Reference	Example Item	Scale	Open Access	No. of FP Items	Total No. of Items
Barnby et al., 2017 [55]	*'During times of stress I have had the feeling that I was being accompanied by an unseen presence'*	Sensed Presence Questionnaire (SenPQ)	Yes	16	16
Jones, Fernyhough, & Meads (2009) [57]	*"I've had the feeling of a presence in the room which I felt was aware of me too, but I could not actually see, hear, touch or smell them"*	Durham Hypnagogic and Hypnopompic Hallucinations Questionnaire (DHQ)	No	4	14
Solomonova et al., 2008 [14]	*'Have you ever had a vivid feeling that someone was standing right behind you or beside you only to find that nobody was there?'*	Other Experiences Questionnaire (OEQ-7)	No	4	7
Mitchell et al., 2017 [54]	*'I have felt an unseen evil presence around me'*	Multi-Model Unusual Sensory Experiences Questionnaire (MUSEQ)	Yes	4	43
Benson et al., 2019 [5]	'*I have had the feeling of the presence of another being, even though nobody was there.'*	Bodily Disturbances Inventory (B-BODI)	Yes	2	21
Kass et al., 1991 [58]	*'How often have you felt close to a spiritual force that seemed to lift you outside yourself?'*	Index of Core Spiritual Experiences (INSPIRIT)	No	2*	7
Rossell et al., 2019 [59]	'*Did you ever have the peculiar sensation that someone or something was present, like a person standing behind*	Questionnaire for Psychotic Experiences (QPE)	Yes	1	50

	you whom you could neither hear nor see nor feel?'				
Eckblad & Chapman, 1983 [60]	*'I have sometimes sensed an evil presence around me, although I could not see it'*	Magical Ideation Scale (MIS)	No	1	30
Bell et al., 2006 [61]	*'Do you ever sense the presence of another being, despite being unable to see any evidence?'*	Cardiff Anomalous Perceptions Scale (CAPS)	Yes	1	32
Wood et al., 2015 [56]	*"Do you feel as though this presence is human, animal, or other?'*	*Patients like me* survey	Yes	1 + 6 sub questions	32
Larøi & van der Linden, 2005 [62]	*'On certain occasions I have had the feeling of the presence of someone close who has deceased'*	French Adaptation of the Launay Slade Hallucination Scale (LSHS-M-II)	No	1	16
Raine, 1991 [63]	'*Have you ever had the sense that some person or force is around you, even though you cannot see anyone?'*	Schizotypal Personality Questionnaire (SPQ)	Yes	1	74

Clinical and non-clinical correlates

FP has been reported in a significant minority of individuals with schizophrenia as an isolated experience (46/100; described as 'guardian angel' hallucinations [64]) but is also associated with auditory hallucinations (10/100; [64]) or simultaneously, with gustatory, auditory, tactile, visual hallucinations (10/100; [64]), and bodily self-disturbance [5]. A more recent survey of early intervention service users in the UK who were voice-hearers found that 21/40 (53%) participants reported FP [8]. FP experiences have also been linked to greater passivity experiences in individuals with psychosis, i.e. loss of agency and ownership over thoughts [65].

FP has been reported to occur among between 25-73% of individuals with Parkinson's Disease [14,56,64,66], although estimates may be lower in community contexts (9/250; 3.6% of participants from the USA [67]). FP were sometimes concomitant with visual hallucinations (10-38%; [14,56,64]), and in a minority of cases preceded by self-reported sleep disturbances, anosmia, and memory decline [56]. The phenomena have also been exaggerated by medication; participants from an outpatient's clinic in France with Parkinson's disease with FP experiences compared to those without FP reported higher equivalent doses of L-Dopa (892mg vs 683mg) although there were no differences in their use of dopaminergic agonists [16], and it is unclear whether this changed the phenomenology of FP experiences. In a Japanese study of those with dementia with Lewy bodies, 23/100 participants were reported to experience FP which also covaried with persecutory ideation [68].

Apart from neurodegenerative disorders, FP experiences have been reported in more focal neurological disorders such as vascular or space-occupying lesions [4,18] most frequently comprising the parietal and temporal lobes of either hemisphere. In focal epilepsy, FP can be experienced as an ictal event [19,33,69] or be part of a person's interictal experiential repertoire [48]; seizures originate typically in the temporal (including the insular) or parietal cortex [70]. Relatedly, those experiencing migraine also frequently experience FP [71], although individuals are reluctant to volunteer the information [72]. In fact, except for Parkinson's disease, neurologists rarely ask about the experience of FP; prevalence rates may be considerably underestimated [1]. Finally, FP has been reported in a majority (30/55, 55% of participants from the USA) of those qualifying as having near-death experiences [13].

In the general population FP appears on a continuum: in moderate amounts FP is related to spirituality and general hallucination proneness, but at the extreme end is associated with psychotic-like experiences. A recent study of the general public in the Netherlands found that 168/5335 (3.1%) spontaneously reported FP in the past month [10]. FP in moderate amounts has been associated with closeness to God [31] and increased religiosity [55]. As FP increases in frequency, FP becomes associated with increased vividness and distress, and associated with to attenuated psychosis symptoms past the threshold for high-risk status [32]. Those reporting FP are also more at risk of stress and loneliness compared to those who did not report any FP experiences [73]. FP has been positively associated with subclinical general

hallucination-proneness and paranoia [31]. Individuals who disclosed a psychiatric diagnosis and identified as voice-hearers reported more concomitant *tactile* experiences alongside FP compared to spiritualist and extreme sport communities [31]. FP is not found to share associations with trait anxiety, general wellbeing, age, or level of education [55,74]. There may be gender effects associated with FP – for example, some survey work has highlighted a greater susceptibility to FP in women in clinical populations [31], although in the general population no effect is found [55].

Theoretical Models and Mechanisms

A neural basis for FP was established in the last century mostly from case studies of epilepsy [1,4,75], Parkinson's disease [16], migraine [71,76], and acute hypoxia during mountaineering [77-78]. Neuropsychological models of FP implicate abnormalities of a cortical network that includes the temporoparietal junction (TPJ), the insula, and the frontoparietal cortex associated with multisensory integration, bodily self-processing, self-other distinction, self-awareness, and mental imagery [4,18,48,65,66] (Figure 2A). There is some evidence to indicate that the 'presence' arises from a misattribution of one's own body perception; a (mis)projection of body map representations including the postural, tactile, and kinaesthetic components [4].

FP has been reported through electrical stimulation. Arzy and colleagues [48] have been able to demonstrate the causal mechanisms underlying FP by electrically stimulating the left TPJ. By disrupting the integration of proprioceptive, tactile, and sensorimotor signals that contribute to the spatial sense of the bodily self, they were able to induce FP and a cluster of positive symptoms of psychosis in a person with no psychiatric history. It is worth noting that in other work, anomalous activity of the TPJ in individuals with schizophrenia has been shown to lead to a misattribution of their own actions to others [79].

Further neuroimaging and sensory-motor experimental data support the view that impaired multisensory integration may lead to weakening bodily-self processing. Lesion mapping of patients experiencing FP identified common cortical hubs (frontoparietal, insular, and temporoparietal cortices) that were associated with reports of more frequent FP experiences versus controls [18]. In the same work, experimenters used a sensory-motor model incorporating synchronous and asynchronous motor stimulation to induce FP. Synchronous conditions led to the illusory feeling of touching one's own back. In asynchronous conditions, participants reported being touched by an invisible presence. Extending this work Bernasconi and colleagues [66] used fMRI during the same sensory-motor experimental task [18] with healthy controls, and lesion mapping of people with Parkinson's disease who experienced an FP during the sensory-motor task, to identify identified a bilateral cortical network underpinning FP: bilateral ventral premotor cortex (vPMC), posterior middle temporal gyrus (pMTG), and inferior frontal gyrus (IFG; Figure 2B; [66]). Individuals with Parkinson's disease that demonstrated weaker connectivity within this network showed greater cognitive decline [66]. These same cortical regions were also analysed in individuals diagnosed with psychosis who

did or not did report passivity experiences [65]: reductions in strength between the right MTG and IFG bilaterally was reduced in individuals with passivity experiences [65].

FP can also be induced following pharmacological manipulation, although the specific mechanisms of action are unclear. Human use of Ayahuasca has highlighted the high frequency of FP within psychedelic experiences [39-40]. However, the use of psychedelics to analyse specific mechanisms of action may not be straightforward. Reviews of the human use of Ayahuasca [80], animal work using N,N-Dimethyltryptamine (DMT; [81]), and imaging studies using other tryptamines [82] highlight the highly distributed functional neural activation associated with psychedelics and underline their relatively unknown downstream pharmacology [83,84]. This makes it difficult to focus on the neurochemical and functional hubs of importance within the psychedelic experience, although this is beginning to be investigated [85].

Notably, while the above examples of neural disruption might *cause* abnormal multisensory integration that leads to disruptions in bodily signals, the phenomenology or subjective experience of the FP depends on how the brain resolves confusion. Psychosocial context and learned regularities [86] play a pivotal role in the identification of the presence, emotions associated with the FP, and the psychiatric outcomes of the experience. For example, in a large sample, it was found that the strongest predictor of FP experiences following a spouse's death was the length of marriage [74]; research on sleep paralysis has linked FP with a general susceptibility to other sleep-related hallucinations (such as voices or visions [28]) and to social anxiety traits [14], suggesting a connection between social cognition in waking like and sleep paralysis FP; in a case study, a 55-year-old woman with a right temporal tumour reported a 'shadow' being without a distinct identity in a distinct spatial location; after her husband's death, she recognized the 'shadow' as her deceased husband ([4]; see Figure 2C, Case 2). Thus, FP experiences are largely shaped and enriched by one's psychosocial environment and strength of social bond. Indeed, the variety of affective and relational properties of FP have led some to describe it as a form of hallucinatory social imagery (see Table S3) [87].

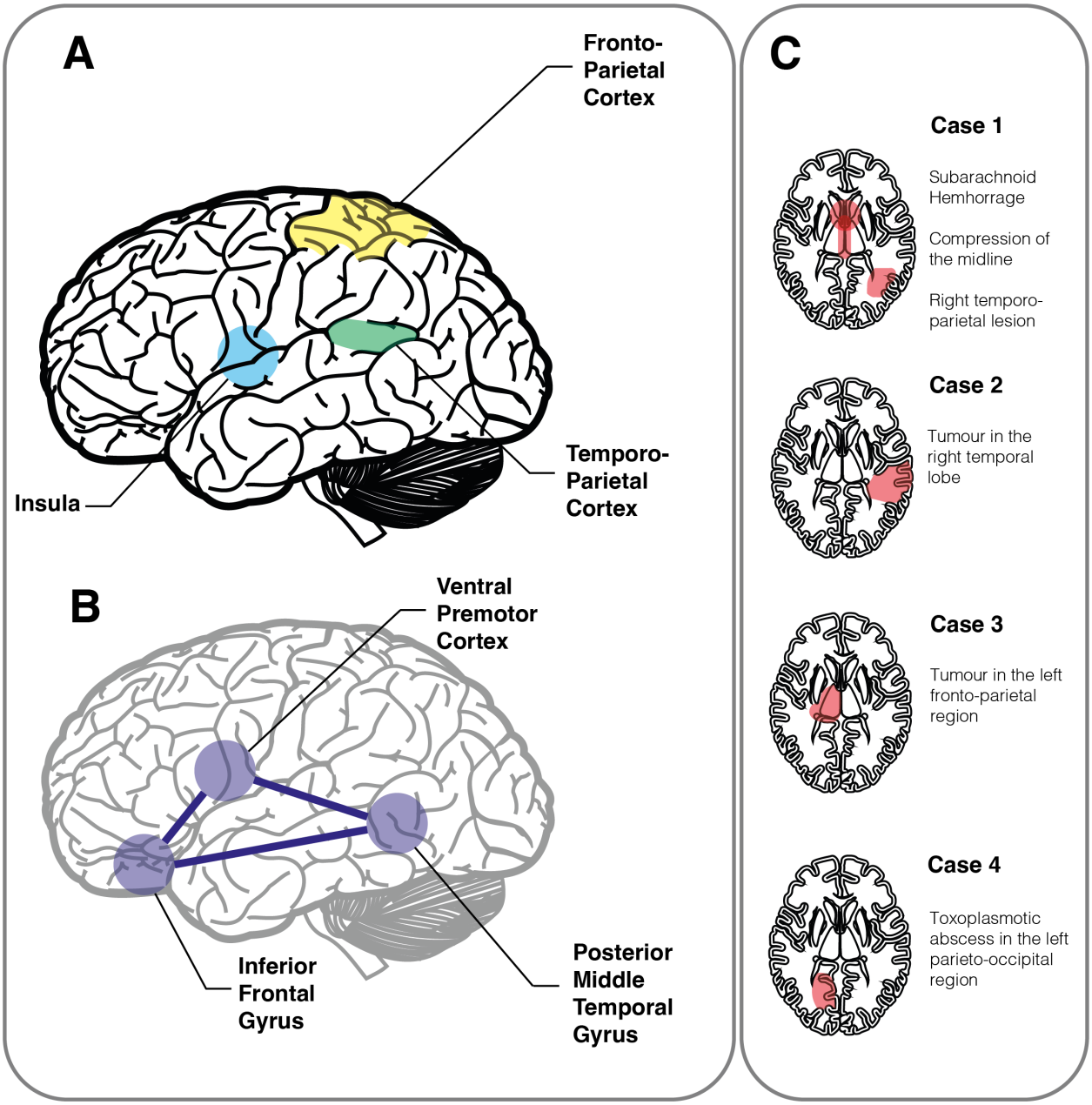

Figure 2. Neural regions implicated in the generation of FP experiences. (A) Common neural regions identified via neuropsychological, stimulation, and lesion mapping studies; the insula is shown here on the cortical surface for approximate location, although resides below the surface of the cortex (B) The 'Presence Hallucination' network suggested to underpin FP experiences [65-66]; regions are bilateral although depicted on the left hemisphere for illustrative purposes. (C) Neuropsychological case reports from [4] demonstrate that there is also non-trivial variance between lesion location and the experience of FP.

Discussion

In this review we have synthesized philosophical, phenomenological, psychometric, cognitive, and neurophysiological perspectives of FP in health and disorder. While the perception itself may feel intuitively 'common,' the emotional impact can range from deeply distressing to comforting, depending on the context (e.g., sleep paralysis vs bereavement) and identity (e.g., anonymous shadow figure vs God) of the presence. While limited, psychometric capture of the FP most commonly probes the presence of FP, more recent measures record the valence of FP experiences. This has uncovered that FP is more common than previously appreciated in those with psychosis and Parkinson's disease. Mechanistically, work describing the FP in focal epilepsy and neurological cases have found that lesions and disruption to temporo-parietal, insula, and frontoparietal regions of the cortex, and subsequent disruptions to proprioceptive signals, appear to predominantly underlie FP experiences. Nevertheless, much is unclear about how, why, and when FP may occur, what prognostic impact it may incur, and what it may highlight about social cognition.

Importantly, FP may often not be an isolated occurrence. Various hallucinations follow from FP; visual, auditory, olfactory, gustatory, where FP may act as a primary sensory kernel to the converging hallucinations [64]. Alternatively, FP may be a corollary, where FP becomes a secondary inference or elaboration of other primary, sensory-specific phenomena, such as auditory-verbal hallucinations [8]. In a clinical context, given the prior work on the factors that influence distress auditory verbal hallucinations – benevolence, power, dominance, intrusiveness, or perceived control [88] – it may be that distress because of FP and concomitant hallucinations involves similar risk factors. Scientifically, understanding the causal neural relationships between FP-supporting regions and regions that encode other sensory stimuli may highlight whether FP-encoding regions are typically activated earlier and propagated to other regions, or vice versa; Dynamic Causal Modelling [89] and laminar analysis [90] may be particularly useful to test hypotheses.

Probing the mechanistic foundation and corollaries of FP creates a need for a common and stable set of measures for FP. Because FP are often perceptually diffuse and lack sensory content, it has been difficult to capture and quantify the FP experience. We currently do not have an instrument that allows us to measure the experience of FP in-depth or with more than one dimension. For example, one dimension is to assess the intensity, vividness, strength, fidelity, and certainty of FP (how real it feels); another is the interpersonal or social quality of the experience (how engaging or interactive is the FP; how many FPs are present; how often is the same FP experienced, what the FPs intentions may be); yet another is the emotional quality of the FP (how it makes the experiencer feel; what the experiencer believes the FP feels). Beginning to develop measures that can capture the social, metacognitive, and emotional flavour of FP as they reveal themselves to the experiencer requires that qualitative studies and clinical reports probe phenomenology in depth. This may provide a nomenclature and common language to quantify and understand FP experiences in larger populations.

Developing a unifying mechanistic framework of FP is non-trivial (see Panel: Key Challenges). Mechanistic explanations of FP can be broadly cast in the predictive processing framework (PPF; 91]); basic alterations to the precision of lower-level sensory information and higher order priors along cortical hierarchies, and their subsequent integration, may lead to the projection of postural and kinaesthetic body maps into extracorporeal space. This is then interpreted as another agent. However, there is yet to be a fully fleshed out PPF account of FP. Experimental evidence of FP aligns closely to traditional 'forward-models' of hallucinations; disruptions to highly tuned proprioceptive bodily sensations – such as feedforward motor signalling [92] – may play a central role in FP.

Recent work in the field of interoceptive modelling may provide a more specific, formal framework to examine distortions to multisensory integration and FP. Formal theory is crucial in psychology and psychiatry to enable replicability, falsification, and generation of precise predictions [93]. Prior work has highlighted the potential causal relationship between distortions to sensory integration and FP [18,65-66], particularly in insular and sensory motor regions. These regions are implicated in current formal theoretical accounts of interoception and proprioception [94-95] (see Table S3) which require the integration of visceral bodily signals that are built upon a hierarchical predictive coding architectures. These formal accounts provide specific regional and neurochemical targets to assess causal induction of FP experiences, and importantly, provide generative empirical predictions.

Following from the initial perception, it is an open question as to the reason why FP experiences may be additionally furnished with personality, emotions and intentionality. First person accounts of FP suggest that under extreme duress, FP may serve to protect the self from isolation [96]. Moreover, during bereavement, FP of the deceased person may be comforting and help mitigate the overwhelming sense of loneliness [44,53]. Anthropologically, the presence of unseen, intentional agents has been noted as a common factor across religions [15]. In psychopathology, the over-perception (i.e., hypersensitivity) of external social agency is a key experience of psychosis [97]. In all cases, extreme stress or traumatic experience may lead to hyperactivity of regions and networks associated with application of social representations - the cognitive structures used to infer intentions, beliefs and actions of others [98]. This is also predicted by the Social Deafferentation Hypothesis [99]; perceptions become imbued with social representations which provide familiar comfort and/or distress. Formal models that provide precise predictions may be used to assess causal factors in the generation of social hallucinations during ambiguous contexts [100]. To offer a more complete picture of FP, formal theories are need that allow researchers to probe the relations between i) higher-order beliefs about the experience, ii) social cognitive processes, iii) how the brain integrates information about the body, and iv) the first-person experience of FP, including its emotional impact and significance.

Importantly, we must translate scientific understanding into clinical utility. Key steps on this path include strong theoretical models, and testing how best to assess and support people with distressing FP. First, we can draw upon prior evidence noted in this review:

FP is a clearly ubiquitous human experience, shaped by sociocultural contexts, is central to our conceptualization and understanding of the sense of self, and important to people with psychosis. A systematic investigation of FP is likely to lead to advances in a wide range of academic disciplines beyond neurological, psychiatric and psychological sciences, and contribute to theory that explains when and why FP may occur. Second, initiatives like POTB [9] draw attention to themes of central importance when developing questions to implement policy to best support those with psychosis; POTB also collects and shares coping strategies. Recognising FP as something prevalent and important to those with psychosis is first step, even if FP is hard to fully grasp at this stage. We are now in a position for the first time to begin a fully integrated science of FP – combining psychiatry, neurology, lived experience, philosophy, anthropology, and formal cognitive theory.

Panel: Key Challenges

1. How do experimenters psychometrically capture the multidimensional nature of FP experiences? Specific measures of FP require that they are able to capture location in space, emotional valence, and complexity of identity.

2. What is the temporal context of FPs; do they frequently precede or supersede other sensory hallucinations?

3. How do experimenters connect the neural mechanisms identified to underpin FP experiences with cognitive mechanisms humans use to detect and interact with other social agents? Experiments that can dissociate the detection of agency with the interpretation of their intentions will be invaluable to parse neural regions which encode both.

4. What is the frequency of FP experiences within psychiatric and neurological cases? Understanding whether FP experiences reflect the underlying severity of the disorder may have diagnostic and prognostic utility.

5. Are FP experiences often overlooked during clinical interviews or qualitative study? If support-seeking participants are not asked about the FP phenomenon, FP-like experiences may erroneously be pooled together with other forms of hallucination, e.g., auditory, tactile. Much like auditory hallucinations, there may be one or more FPs within a participant's day-to-day experience, each with different personified characteristics.

6. What are the major sociocultural constraints on FP? It is unclear whether FP experiences always becomes personified within the social and cultural milieu of the experiencer. This will require increased qualitative research to explore detailed and more nuanced phenomenological descriptive across context and cultural influences.

Search Strategy and Selection Criteria

Search strategy and selection criteria for this review were identified through searches of PubMed and Google Scholar for articles published from January 1971 to July 2022. Authors used terms “felt presence” OR “sensed presence” OR ‘extracampine hallucination’ OR ‘heautoscopy’ AND ‘non-clinical voice hearers’ OR ‘psychometric measurement’ OR ‘phenomenology’ OR ‘social agent representation’ OR ‘Parkinson’s disease’ OR ‘brain lesion’ OR ‘epilepsy’ OR ‘schizophrenia’ OR ‘psychosis’ OR ‘bereavement’ OR ‘Ayahuasca’ OR ‘sleep paralysis’ OR ‘tulpamancy’ OR ‘religious experience’ OR ‘trauma’. Articles resulting from these searches and relevant references cited in those articles were reviewed. We used an unsystematic approach, using key literature known to the authors, and references cited within key literature. The 100 examples of cited literature we include covered a wide range of key studies looking at philosophical, phenomenological, psychometric, neuroscientific, computational, and neuropsychological approaches to Felt Presence experiences. With a few exceptions, only articles published in English were included.

Funding

NA

Declaration of Interests

None to declare.

Author Contributions

Conceptualisation: JMB, BAD, SP
Investigation: JMB, BAD, SP, PB, CR, TB
Methodology: JMB, BAD, SP, PB, CR, TB
Project Administration: JMB, BAD
Supervision: BAD, PB, SP
Visualisation: JMB
Writing – Original Draft: JMB
Writing – Review and Editing: JMB, BAD, SP, PB, CR, TB

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Supplementary Materials

Table S1. Variety and definition of terms for FP.

Term	Reference
Bodily awareness (*leibhaftige Bewusstheit*)	Jaspers, 1913*
Heautoscopy without optical image	Menninger-Lerchenthal, 1935
Phantom impression	Lippman, 1951
Bipartition fantasy	Critchley, 1953 (also in 1955)**
Idea of a presence	Critchley, 1955
False bodily awareness	Trethowan, 1979
The Third Man	Seifert and Clake, 1979
Anwesenheit	Thompson, 1982
Alloscopy	Turner, 1983
False proximate awareness	Koehler and Sauer, 1984
Phantom boarders	Rowan, 1984
Sensed presence	Suedfeld & Mocellin, 1987
Feeling of somebody nearby	Ardila and Gomez, 1988
Somaesthetic doppelgänger	Grüsser and Landis, 1991
Feeling of a presence	Brugger., et al., 1996
Invisible doppelgänger	Brugger et al., 1996
Synthetic 'ghost'	Persinger et al., 2000
Extracampine hallucination***	Chan and Rossor, 2002
(whole body) Paroxysmal Somatognosic Disorder	Blanke et al., 2003
Hallucinatory social imagery	Nielsen, 2007
Illusory shadow person	Zijlmans et al. 2009
Guardian Angel Hallucination	Llorca et al., 2016
Presence hallucination	Vehar et al., 2022

* Alluding to the multitude of contexts FP were described, Jaspers notes that the phenomenon in question would now have a brief label ("leibhaftige Bewusstheiten") that brings their property to the point (p. 157).
** reserved for the FP as identified as one's own self (transition to heautoscopy)
*** This is the unfortunate re-use of a term originally proposed for another type of hallucination: the seeing (as a phenomenally unequivocally *visual* experience) of things outside the field of vision (Bleuler, 1903)

Table S2. Initial qualitative dimensions of FP identified from the literature.

These initial, non-exhaustive terms are examples that may be used to better describe FP in clinical or scientific reports. We have drawn these terms from other strands of hallucinations research, in addition to FP research.

Physical Qualities (of the presence)
Spatial specificity (Vague sense of presence, presence is in a specific location)
Proximal Location (Behind, In Front, Left, Right, Above, Below)
Externality (Inside or Outside of the body)
Distance (Near, Far)
Movement (Static, Ambulating)
Social Qualities (of the presence)
Personification (ambiguous identity, specific character)
Intentions (To hurt, To help)
Interaction (Uni or bi-directional communication)
Emotional Qualities (of the experiencer)
Valence (negative feeling, positive feeling)
Intensity (very intense, not noticeable at all)
Distress (very distressing, not at all distressing)
Context (of the experiencer)
Frequency (happens all the time, happens only during the night)
History (I have always known it to occur, It only started occurring after X)
Physical space (Can happen anywhere, only occurs in X location)

Table S3. Glossary of technical terms used in this paper

Term	Description
Agency	The experience that we have control over our actions, thoughts, bodily sensations, and feelings.
Ayahuasca	A liquid psychedelic brew that typically contains Dimethyltryptamine (DMT) and harmala alkaloids (monoaminoxidase inhibitors).
Dopamine	A neurochemical modulator related to the coordination and activation of motor movement and associative learning processes.
Dynamic Causal Modelling (DCM)	A computational technique used to approximate the influence of cortical regions on one another by measuring their coactivation over time and across contexts.
External/Social Agent	A being in the environment that has its own encapsulated set of beliefs, intentions, and actions, and is experienced as separate to one's sense of self.
Felt presence	The basic feeling that someone else is present in the immediate environment without any other clear sensory evidence
Formal Model	A mathematical theory that relates to a specific functional process, e.g. learning and decision making. In cognitive science, they are a series of interrelated equations that take information from the environment and transform it into actions. Formal models allow the generation of precise predictions through the simulation of synthetic data.
Hallucination	A false sensory perception that is generated by the experiencer in absence of any external stimuli
Hypnagogic/Hypnopompic	The experience of a hallucination upon falling asleep (hypnagogic) or waking up (hypnopompic).
Interoception	The ability to sense and monitor one's own internal, visceral bodily sensations, e.g. hunger, stress, pain
Proprioception	The ability to sense and monitor one's own motor movements and bodily coordination.
Social Imagery	An internally generated percept that is imbued with the psychological qualities of a social agent. Of note, hallucinations often involve an experience of a social agent in a variety of modalities (eg., voices, felt presence, multisensory hallucinations)