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DOI:
[10.4453/rifp.2021.0014](https://doi.org/10.4453/rifp.2021.0014)

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Document Version
Publisher's PDF, also known as Version of record

Citation for published version (Harvard):
Bortolotti, L & Belvederi Murri, M 2021, 'Can there be delusions of pain?', *Rivista internazionale di Filosofia e Psicologia*, vol. 12, no. 2, pp. 167-172. <https://doi.org/10.4453/rifp.2021.0014>

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FORUM

Can there be delusions of pain?*

Lisa Bortolotti^(α) & Martino Belvederi Murri^(β)

Ricevuto: 1 marzo 2021; accettato: 27 aprile 2021

Abstract Jennifer Radden argues that there cannot be delusional pain in depression, putting forward three arguments: the argument from falsehood, the argument from epistemic irrationality, and the argument from incongruousness. Whereas delusions are false, epistemically irrational, and incongruous with the person's experience, feeling pain from the first-person perspective cannot be false or irrational, and is congruous with the person's experience in depression. In this commentary on Radden's paper, we share her scepticism about the notion of delusional pain, but we find the arguments from falsehood and incongruousness ultimately unconvincing, given that delusions are not always false or incongruous. Rather, we develop the argument from epistemic irrationality, suggesting that, although some aspects of pain (its cognitive and emotional components) may exhibit informational plasticity and other characteristics shared by mental states that can be assessed for their rationality, the sensory component of pain does not.

KEYWORDS: Delusion; Pain; Epistemic Irrationality; Incongruousness; Falsity; Depression

Riassunto *Ci può essere dolore delirante?* – Jennifer Radden sostiene che non può esserci dolore delirante nella depressione, proponendo tre argomentazioni che si basano sulla falsità, l'irrazionalità epistemica e l'incongruenza. Mentre i deliri sono falsi, epistemicamente irrazionali e incongruenti con l'esperienza della persona, provare dolore in prima persona non può essere falso o irrazionale ed è congruo con l'esperienza di una persona che è depressa. In questo commento all'articolo di Radden, condividiamo il suo scetticismo nei confronti della nozione di dolore delirante, ma troviamo le argomentazioni basate sulla falsità e l'incongruenza in ultima analisi non del tutto convincenti, dato che i deliri non sono sempre falsi o incongrui. Piuttosto, sviluppiamo l'argomentazione basata sull'irrazionalità epistemica, suggerendo che, sebbene alcuni aspetti del dolore (le sue componenti cognitive ed emotive) possano esibire plasticità e altre caratteristiche condivise da stati mentali che vengono valutati per la loro razionalità, la componente sensoriale del dolore non lo fa.

PAROLE CHIAVE: Delirio; Dolore; Irrazionalità epistemica; Incongruenza; Falsità; Depressione

*Comment on J. RADDEN, *Imagined and delusional pain*, Forum on *Imagining pain*, in: «Rivista internazionale di Filosofia e Psicologia», vol. XII, n. 2, 2021, pp. 151-206.

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1 Introduction

IN THE FASCINATING PAPER, *Imagined and delusional pain*, Jennifer Radden argues that there cannot be delusional pain, because one cannot imagine being in pain from the inside when one is not in pain and, given the nature of delusions, being in pain or feeling pain cannot be falsely or irrationally believed. However, she acknowledges that there can be delusions about pain, that is, one can have false and epistemically problematic beliefs about the origins of one's pain or about some other characteristics of one's pain.

Radden is interested in dispelling the myth that pain in depression can be delusional, an idea that (on one interpretation) Kant himself defended, comparing pain in depression to illness in hypochondria — as the person with hypochondria complains about having an illness but is not ill, the person with depression complains about being in pain but is not in pain. We share Radden's conclusion that we should resist the idea of delusional pain, but for reasons that are only partially overlapping with Radden's. Radden's argument against delusional pain is based on three considerations: (a) one cannot be mistaken about feeling pain but delusions are typically false; (b) feeling pain cannot be irrational but delusions are epistemically irrational; (c) feeling pain is congruous with the beliefs and affections of people with depression but delusions are usually incongruous with one's beliefs and affections. We shall discuss (a) in section 2; (b) in section 3; and (c) in section 4.

2 Can "I feel pain" be false?

In the first section of her paper, Radden argues that there are some circumstances in which one can imagine that one is in pain. One can imagine that one is in pain *from a third person perspective*, for instance creating «an image of myself wracked and contorted through injury or disease, or frozen with depressive despair». ¹ One can also imagine (*propositionally*) that one has a pain in one's leg or that one's headache is getting more intense. But one cannot imagine being in pain or feeling pain *simpliciter, from the inside*. Radden argues that this inability to imagine being in pain from the inside is what rules out the possibility of delusional pain. We agree with Radden that we should resist the idea of delusional pain, and that one cannot imagine that one is feeling pain from the inside. But we do not think that whether pain can be imagined from the inside is relevant to whether delusional pain is possible, because it is not clear to us that an experience needs to be imagined to be the object of a delusion. Rather, we suggest that pain is not the appropriate object of delusions because of its essential sensory and perceptual components.

The experience of pain emerges first of all from an essential somatic, physical component which is derived by a sensory apparatus and leads to (prereflective, nonintentional, implicit or preconceptual) perceptions that may reach the realm of consciousness. This is accompanied by an affective component, which we might call "suffering" — which as Radden rightly points out, amounts to an affection. Not coincidentally, both people with depression and their carers often represent (or "metaphorize") psychological suffering as "mental pain". Also not coincidentally, the negative affective state of pain is accompanied by activation of brain areas that occurs when one experiences negative emotions due to other causes. ² Lastly, these fundamental aspects of pain are integrated with other cognitive processes (that can be reflective, intentional, explicit and conceptual) and with one's behaviour.

One argument against delusional pain could run as follows: since pain is largely and fundamentally a *sensory* and *perceptual* experience, a relevant question would be whether pain might be *hallucinated*, rather than be *delusional*. In other words, one may argue that the cognitive or affective correlates of pain might be experienced as part of a delusional state, but not the sensory one. Radden seems to discard this hypothesis when she writes that pain does not involve presentation of sensory qualities. But we believe this is at best an incomplete account of pain: nociception involves the presentation and perception of chemical/physical events that are internal to the body — similar to the sense of balance or proprioception — and are transmitted to the brain. There are obvious differences between pain and the classical "five senses", but they don't relate to the possibility of evoking neural and subjective (cognitive and affective) responses or being amenable to representations. Both perception based on the five "external" senses, and the "internal" sensory events, moreover, are not merely passive phenomena but increasingly recognized as the product of complex, largely implicit, neural inference, that is, the integration of prior expectations with sensory data. ³

In other words, the brain makes continuous "top-down" predictions with varying degrees of precision and confidence, which matches "bottom-up" sensory data on the grounds of a specific anatomo-functional correspondence. ⁴ Thus, hallucinations are less and less accepted as mere "perceptions in the absence of an object" and more as distorted forms of an implicit, active process. Interestingly, this "predictive coding" / "active inference" view is also apparently congruent with a phenomenological view of perception as an active *attunement* between the subject and sensory stimuli. ⁵ In some regards, particularly in some neural mechanisms that underlie these phenomena, delusions and hallucinations (as well as other symp-

toms of mental disorders) may indeed share some characteristics: they both implicate altered *neural* inference and altered models of the external world and/or internal body states.⁶

This, however, would not necessarily mean that delusions of pain are possible. The first clash between the idea of delusional pain and the traditional view of delusions concerns falsehood: one can have beliefs that can be true or false and that can be verified or falsified by an external observer. (Delusions are defined as false beliefs in the DSM-5).⁷ However, one cannot have experiences of pain that are not veridical and that are verified or falsified by an external observer, for some of the reasons that Radden discusses when she argues for the impossibility of imagining pain from the inside.

People can experience pain not only because of self-evident organic lesions, but also because of lesions that pertain to the sensory system itself.⁸ A notable example is the phantom limb, where pain is felt even in the absence of the tissue.⁹ Even when medical diagnostic procedures and/or clinical reasoning would tend to rule out the presence of pain, a clinician cannot definitively prove that “I feel pain” is false, whereas they could prove that some delusional propositions related to the external world (which is shared between the observer and the subject) are false. In some cases pain may be deemed of exaggerated intensity with respect to the objective lesion, and labelled as a “*medically unexplained symptom*”, but even then the possibility of a true subjective experience cannot be denied.¹⁰

3 Can “I feel pain” be irrational?

For Radden, the view that pain can be delusional clashes with influential accounts of delusions, especially what she calls *the traditional view*, the view that delusions are false and irrational beliefs from an epistemic, procedural, or agential point of view. We already discussed falsehood and we turn now to the other features of the traditional view of delusions.

Violations of *epistemic rationality* are central to the traditional understanding of delusions and even more central to delusions than falsehood. Although some delusions can turn out to be true, for a belief to be delusional it needs to have a problematic relationship with evidence. We know that beliefs can be evaluated epistemically, as rational or irrational depending on whether they are well supported by or responsive to evidence.¹¹ Delusional beliefs are often found to be both badly supported by evidence and irresponsive to counterevidence, though their being strenuously resistant to counterargument and counterevidence (their so-called *fixity*) is what is most distinctive about them. Can the feeling of pain be assessed as rational or irrational?

Maybe only in part. Pain has been recently redefined as «an unpleasant sensory and emotional experience associated with, or resembling that associated with, actual or potential tissue damage».¹² This revised definition puts cognitive aspects (as opposed to sensory and affective dimensions) at the periphery of the phenomenon of pain. However, it stresses the notion that pain should not be reduced to a mere neurological function and is amenable to profound influences by biological, psychological, and social factors. One might argue that, to a certain extent, some experiences involving affective attitudes, such as anxiety, may be evaluated epistemically. For instance, one’s anxious state of mind may be considered as justified or unjustified depending on the person’s situation. A person who has nothing to fear from delivering a forthcoming lecture and has already a vast experience in public speaking can seem to be unjustifiably anxious about the event, from the perspective of a neutral observer, because there is no objective evidence suggesting that the event poses a genuine threat to the speaker. This lack of justification may just be apparent because, if the person is anxious, they may have some reason to fear the upcoming performance that is not available to the neutral observer, such as fear of delivering a sub-optimal or unsatisfying speech. However, in the case of pain the question about justification does not even arise, because the core of the experience of pain is a bodily sensation and whether one has evidence for feeling pain is not relevant – one does not need evidence.

But could pain be assessed for its epistemic rationality in its cognitive or affective components rather than in its sensory component? In order to be assessed as epistemically rational, pain would need to satisfy at least three requirements:¹³ an *information* requirement, that is, providing agents with some information about the world or about themselves; a *motivation* requirement, that is, having an “epistemic force” that leads agents to act on the provided information; a *plasticity* requirement, that is, changing when new relevant information become available. Pain provides information about the world and about oneself and it leads one to act based on that information. Giovanni’s hands feeling uncomfortable and numb when he is walking through a snowstorm without gloves tell him that it is really cold outside (too cold not to wear gloves) and that he should find a way to warm up his hands to avoid lasting damage to them. Recent neuroscientific research has further challenged the notion of pain as a fixed perceptual experience. Pain seems to display at least some degree of informational plasticity. Information that Giovanni may acquire about his environment (e.g., that it is only -10C outside and so the risk of frostbite is very low) may not entirely eliminate the discomfort and numbness he feels in

his hands. However, further information (such as seeing a pair of gloves in front of him) or some distraction (i.e. other stimuli entering the field of his attention, not necessarily as intense as a bear chasing him) may provide some actual relief to the experience of pain, either by modulating the biological processes at the basis of pain, or by changing the expectation or inferences about the pain that he is experiencing.¹⁴ Another example may be that of a woman who experiences the pain of the contractions during labour and is relieved to hear that in 20 minutes the epidural she was administered will take effect: this information may affect the levels of pain she is experiencing, although it does not eliminate the pain.¹⁵ Similar effects have been argued to derive from hypnosis, a technique that may work by modulating expectation through suggestion.¹⁶

4 Can “I feel pain” be incongruous with other cognitive and affective states?

Another potential clash between the idea of delusional pain and the traditional view of delusions concerns procedural and agential rationality.¹⁷ In order to assess a belief's procedural and agential rationality, we need to consider how the belief fits with the person's other mental states and whether it is reflected in the person's behaviour. A belief is *procedurally rational* if it is consistent with and supports the person's other doxastic and affective states. Anya's belief that she will make a great computer scientist is procedurally rational if Anya has other mental states that fit with that belief: she knows that she is good at maths, she enjoys coding and programming, she is content with the idea of working in an office, she imagines being an effective team-member, and so on. A belief is *agentially rational* if it is reflected in the person's behaviour and drives the person's actions that are relevant to the content of the belief. Again, Anya's belief that she will make a great computer scientist is agentially rational if it leads her to apply for a Computer Science programme at university.

In the philosophical literature, delusions are considered as notoriously bad at integrating with the rest of the person's mental life and behaviour. Some delusions seem to be strangely at odds with the rest of the person's behaviour, which motivates the notion of *double-awareness* or *double-bookkeeping*,¹⁸ the idea that the person with delusions is simultaneously committed to an actual reality and a delusional reality where the two realities collide, leading to inaction. Examples include the hospitalised patient who claims that the nurses want to poison him but eats the hospital food anyway¹⁹ or the woman who claims to be royalty and yet does not find it strange that she is asked to scrub the floor.²⁰ A closer look at a variety of delusions and at affect and motivation in people who

report delusions suggests that the picture is more complicated than those examples suggest: people could have feelings and attitudes that are congruous with the content of their delusions and act on their delusions if they were not affected by avolition and emotional disturbances, or if their behaviour were not inhibited by fear of social sanctioning or other environmental factors.²¹ As a result, people with delusions may fail to acquire or sustain the motivation to express feelings and attitudes that fit with their delusion, or to act in accordance with it. That said, there are many cases, possibly the majority of cases, where delusions are accompanied by congruous emotional profiles and are also acted upon. People with delusions of passivity may wear a cap to prevent third party from inserting thoughts into their heads; people with Cotard delusion may stop bathing and eating; quite commonly, people with persecutory delusions avoid situations they perceive as threatening; and people with delusions of guilt inflict injuries on themselves as a form of punishment.

The last example is probably the most relevant in the context of Radden's discussion, because we do know that in depression delusional beliefs tend to be congruous with the person's mood, and delusions of guilt are not infrequent, often “vindicating” the person's negative self-conceptions.²² Psychotic depression can be accompanied by feelings of guilt, and obsessive self-accusations. Most delusions in this context have a content that matches the person's experience. Common themes include persecution, guilt, punishment, personal inadequacy, or disease. Thus, Radden may be right that pain in the person with depression is congruous with the person's other doxastic and affective states and with the person's behaviour, contributing to coherence and integration. But for pain as signalling bodily damage to be congruous with the experience of people with depression, it would have to be related specifically to the idea of disease or lesions, which is not necessarily present in depression. In any case, the congruousness of pain with other cognitive and affective states in depression is not by itself sufficient reason to claim that pain cannot be delusional. If in depression pain is mood-congruous, so are delusions. In particular, delusions play the role of confirming the negative conception that people have about themselves, reducing the tension between how people feel (e.g., guilty and inadequate) and what people have reason to believe (e.g., that bad events are not their fault). The mention of pain in depression may be due to another phenomenon: patients talk about “mental pain”. Rather than referring to a delusional experience of pain, “mental pain” is often used as a metaphor or similitude for suffering. Thus, patients may mislabel a subjective experience which shares various features with actual physical pain, probably based on its resemblance

with the experience of pain.

5 Conclusions

In this brief commentary, we argued that Rad-den is right to resist the idea of delusional pain in depression, but not all of the arguments she used to reach this conclusion are compelling.

First, we are not sure how the claims about the impossibility of imagining being in pain or feeling pain from the inside are relevant to delusional pain, given that it is not obvious that delusions involve imagination.

Second, delusions do not need to be false, so the fact that experiences of pain cannot be false does not rule out that they are the object of delusions.

Third, delusions do not need to be incongruous with the person's other cognitive and affective states – and they are typically congruous with self-related beliefs and emotions in depression. So, the fact that experiences of pain cannot be false and that they are congruous to self-related beliefs and emotions in depression does not rule out that they are the object of delusions.

It is the argument from epistemic rationality that carries most of the weight in rejecting the possibility of delusions of pain. There seems to be a real disanalogy between delusions and the experience of pain when it comes to their being the appropriate object of epistemic evaluation. Some aspects of pain (its cognitive and emotional components) may exhibit informational plasticity and other characteristics of mental states that can be assessed for their rationality, but its sensory component does not. Whereas delusion is an epistemic concept with an epistemic definition, primarily characterised in lay and clinical contexts by its epistemic irrationality, pain is not.

Acknowledgements

We would like to thank Luigi Grassi and Matilde Aliffi for comments on earlier drafts of this commentary.

Notes

¹ J. RADDEN, *Imagined and delusional pain*, p. 153.

² Cf. L.A.M. DAHLKE, J.J. SABLE, F. ANDRASIK, *Behavioral therapy: Emotion and pain, a common anatomical background*.

³ Cf. D. BENRIMOH, T. PARR, R.A. ADAMS, K. FRISTON, *Hallucinations both in and out of context: An active inference account*; P.R. CORLETT, G. HORGA, P.C. FLETCHER, B. ALDERSON-DAY, K. SCHMACK, A.R. POWERS, *Hallucinations and strong priors*; F. FARDO, R. AUKSZTULEWICZ, M. ALLEN, M.J. DIETZ, A. ROEPSTORFF, K.J. FRISTON, *Expectation violation and attention to pain jointly modulate neural gain in somatosensory cortex*.

⁴ Cf. T. PARR, G. REES, K.J. FRISTON, *Computational*

neuropsychology and bayesian inference; C. TEUFEL, P.C. FLETCHER, *Forms of prediction in the nervous system*.

⁵ Cf. B. ALDERSON-DAY, K. DIEDEREN, C. FERNYHOUGH, J.M. FORD, G. HORGA, D.S. MARGULIES, S. MCCERTHY-JONES, G. NORTHOFF, J.M. SHINE, J. TURNER, V. VAN DE VEN, R. VAN LUTTERVELD, F. WATERS, R. JARDRI, (2016). *Auditory hallucinations and the Brain's resting-state networks: findings and methodological observations*; G. NORTHOFF, *Are auditory hallucinations related to the brain's resting state activity? A "neurophenomenal resting state hypothesis"*.

⁶ Cf. M.D. RAMSTEAD, C. HESP, A. TSCHANTZ, R. SMITH, A. CONSTANT, K. FRISTON, *Neural and phenotypic representation under the free-energy principle*; W. TSCHACHER, A. GIERSCH, K. FRISTON, *Embodiment and schizophrenia: A Review of implications and applications*.

⁷ Some delusions researchers in philosophy and cognitive science have pointed out that falsehood is a typical but not necessary feature of delusions (cf., e.g. M. COLTHEART, *Cognitive neuropsychiatry and delusional belief*).

⁸ Cf. S. CANAVERO, V. BONICALZI, *Central pain syndrome: Elucidation of genesis and treatment*.

⁹ Cf. H. FLOR, *Phantom-limb pain: Characteristics, causes, and treatment*.

¹⁰ Cf. A.C. AMANDA, M. CELLA, *Medically unexplained symptoms and pain: Misunderstanding and myth*.

¹¹ L. BORTOLOTTI, *Delusions and other irrational beliefs*.

¹² S.N. RAJA, D.B. CARR, M. COHEN, N.B. FINNERUP, H. FLOR, S. GIBSON, F. KEEFE, J.S. MOGIL, M. RINGKAMP, K.A. SLUKA, X.-J. SONG, B. STEVENS, M.D. SULLIVAN, P.R. TUTELMAN, T. USHIDA, K. VADER, *The revised International Association for the Study of Pain definition of pain: Concepts, challenges, and compromises*.

¹³ Cf. M. ALIFFI, *The epistemic rationality of emotions: A new defence*.

¹⁴ Cf. F. FARDO, R. AUKSZTULEWICZ, M. ALLEN, J.M. DIETZ, A. ROEPSTORFF, K.J. FRISTON, *Expectation violation and attention to pain jointly modulate neural gain in somatosensory cortex*; H.L. FIELDS, *How expectations influence pain*; B. SEYMOUR, J.P. O'DOHERTY, M. KOLTZENBURG, K. WIECH, R. FRACKOWIAK, K. FRISTON, R. DOLAN, *Opponent appetitive-aversive neural processes underlie predictive learning of pain relief*.

¹⁵ Cf. S. ELSENBRUCH, *How positive and negative expectations shape the experience of visceral pain*.

¹⁶ Cf. G.B. SERRANO, L.P. RODRIGUES, B. SCHEIN, A. SOUZA, I.L.S. TORRES, L. DA CONCEIÇÃO ANTUNES, F. FREGNI, W. CAUMO, *Comparison of hypnotic suggestion and transcranial direct-current stimulation effects on pain perception and the descending pain modulating system: A crossover randomized clinical trial*.

¹⁷ Cf. L. BORTOLOTTI, *Delusions and other irrational beliefs*.

¹⁸ L. SASS, *Some reflections on the (analytic) philosophical approach to delusion*.

¹⁹ Cf. S. GALLAGHER, *Delusional realities*.

²⁰ Cf. E. BLEULER, *Dementia praecox or the group of schizophrenias*.

²¹ Cf. L. BORTOLOTTI, M.R. BROOME, *Affective dimensions of the phenomenon of double bookkeeping in delusions*.

²² Cf. M. ANTROBUS, L. BORTOLOTTI, *Depressive delusions*.

References

- ALDERSON-DAY, B., DIEDEREN, K., FERNYHOUGH, C., FORD, J.M., HORGA, G., MARGULIES, D.S., MCCERTHY-JONES, S., NORTHOFF, G., SHINE, J.M., TURNER, J., VAN DE VEN, V., VAN LUTTERVELD, R., WATERS, F., JARDRI, R. (2016). *Auditory hallucinations and the Brain's resting-state networks: findings and methodological observations*. In: «Schizophrenia Bulletin», vol. XLII, n. 5, pp. 1110-1123.
- ALIFFI, M. (2019). *The epistemic rationality of emotions: A new defence*, Ph.D. dissertation, University of Birmingham – URL: <https://etheses.bham.ac.uk/id/eprint/9424/7/Aliffi2019PhD.pdf>.
- AMANDA, A.C., CELLA, M. (2012). *Medically unexplained symptoms and pain: Misunderstanding and myth*. In: «Current Opinion in Supportive and Palliative Care», vol. VI, n. 2, pp. 201-206.
- ANTROBUS, M., BORTOLOTTI, L. (2016). *Depressive delusions*. In: «Filosofia Unisinos», vol. XVII, n. 2, pp. 192-201.
- BENRIMOH, D., PARR, T., ADAMS, R.A., FRISTON, K. (2019). *Hallucinations both in and out of context: An active inference account*. In: «PLoS ONE», vol. XIV, n. 8, Art.Nr. 0212379 - doi: 10.1371/journal.pone.0212379.
- BLEULER, E. (1950). *Dementia praecox or the group of schizophrenias* (1911), translated by J. ZINKIN, International Universities Press, New York.
- BORTOLOTTI, L. (2009). *Delusions and other irrational beliefs*, Oxford University Press, Oxford.
- BORTOLOTTI, L., BROOME, M.R. (2012). *Affective dimensions of the phenomenon of double bookkeeping in delusions*. In: «Emotion Review», vol. IV, n. 2, pp.187-191.
- CANAVERO, S., BONICALZI, V. (2007). *Central pain syndrome: Elucidation of genesis and treatment*. In: «Expert Review of Neurotherapeutics», vol. VII, n. 11, pp. 1485-1497.
- COLTHEART, M. (2007). *Cognitive neuropsychiatry and delusional belief*. In: «Quarterly Journal of Experimental Psychology», vol. LX, n. 8, pp. 1041-1062.
- CORLETT, P.R., HORGA, G., FLETCHER, P.C., ALDERSON-DAY, B., SCHMACK, K., POWERS, A.R. (2019). *Hallucinations and strong priors*. In: «Trends in Cognitive Sciences», vol. XXIII, n. 2, pp. 114-127.
- DAHLKE, L.A.M., SABLE, J.J., ANDRASIK, F. (2017). *Behavioral therapy: Emotion and pain, a common anatomical background*. In: «Neurological Sciences», vol. XXXVIII, Supplement 1, pp. 157-161.
- ELSENBRUCH, S. (2014). *How positive and negative expectations shape the experience of visceral pain*. In: F. BENEDETTI, P. ENCK, E. FRISALDI, M. SCHEDLOWSKI (eds.), *Placebo*, Springer, Berlin/Heidelberg, pp. 97-119.
- FARDO, F., AUKSZTULEWICZ, R., ALLEN, M., DIETZ, M.J., ROEPSTORFF, A., FRISTON, J.K. (2017). *Expectation violation and attention to pain jointly modulate neural gain in somatosensory cortex*. In: «NeuroImage», vol. CLIII, pp. 109-121 - doi: 10.1016/j.neuroimage.2017.03.041.
- FIELDS, H.L. (2018). *How expectations influence pain*. In: «Pain», vol. CLIX, Supplement 1, pp. S3-S10.
- FLOR, H. (2002). *Phantom-limb pain: Characteristics, causes, and treatment*. In: «Lancet Neurology», vol. I, n. 3, pp. 182-189.
- GALLAGHER, S. (2009). *Delusional realities*. In: M.R. BROOME, L. BORTOLOTTI (eds.), *Psychiatry as cognitive neuroscience: Philosophical perspectives*, Oxford University Press, Oxford, pp. 245-266.
- NORTHOFF, G. (2014). *Are auditory hallucinations related to the brain's resting state activity? A "neurophenomenal resting state hypothesis"*. In: «Clinical Psychopharmacology and Neuroscience», vol. XII, 3, pp. 189-195.
- PARR, T., REES, G., FRISTON, K.J. (2018). *Computational neuropsychology and bayesian inference*. In: «Frontiers in Human Neuroscience», vol. XII, Art.Nr. 61 - doi: 10.3389/fnhum.2018.00061.
- RAJA, S.N., CARR, D.B., COHEN, M., FINNERUP, N.B., FLOR, H., GIBSON, S., KEEFE, F., MOGIL, J.S., RINGKAMP, M., SLUKA, K.A., SONG, X.-J., STEVENS, B., SULLIVAN, M.D., TUTELMAN, P.R., USHIDA, T., VADER, K. (2020). *The revised International Association for the Study of Pain definition of pain: Concepts, challenges, and compromises*. In: «Pain», vol. CLXI, n. 9, pp. 1976-1982.
- RAMSTEAD, M.D., HESP, C., TSCHANTZ, A., SMITH, R., CONSTANT, A., FRISTON, K. (2021). *Neural and phenotypic representation under the free-energy principle*. In: «Neuroscience and Biobehavioral Reviews», vol. CXX, pp. 109-122 - doi: 10.1016/j.neubiorev.2020.11.024.
- SASS, L. (2004). *Some reflections on the (analytic) philosophical approach to delusion*. In: «Philosophy, Psychiatry & Psychology», vol. XI, n. 1, pp. 71-80.
- SERRANO, G.B., RODRIGUES, L.P., SCHEIN, B., SOUZA, A., TORRES, I.L.S., DA CONCEIÇÃO ANTUNES, L., FREGNI, F., CAUMO, W. (2019). *Comparison of hypnotic suggestion and transcranial direct-current stimulation effects on pain perception and the descending pain modulating system: A crossover randomized clinical trial*. In: «Frontiers in Neuroscience», vol. XIII, Art.Nr. 662 - doi: 10.3389/fnins.2019.00662.
- SEYMOUR, B., O'DOHERTY, J.P., KOLTZENBURG, M., WIECH, K., FRACKOWIAK, R., FRISTON, K., DOLAN, R. (2005). *Opponent appetitive-aversive neural processes underlie predictive learning of pain relief*. In: «Nature Neuroscience», vol. VIII, n. 9, pp. 1234-1240.
- TEUFEL, C., FLETCHER, P.C. (2020). *Forms of prediction in the nervous system*. In: «Nature Reviews Neuroscience», vol. XXI, n. 4, pp. 231-242.
- TSCHACHER, W., GIERSCH, A., FRISTON, K. (2017). *Embodiment and schizophrenia: A Review of implications and applications*. In: «Schizophrenia Bulletin», vol. XLIII, n. 4, pp. 745-753.