MedCrave
Step into the World of Research

Journal of Psychology & Clinical Psychiatry

Research Article

Open Access

CrossMark

Infinite Singletons and the Default Mode Network

Abstract

In the present contribution we sketch an interpretation of the characterizing aspects of processing taking place in the Default Mode Network based on a formal logic model of the psychoanalytic theory. In particular, we apply a logical model of the structural Freudian Unconscious as described in the so-called Bi-Logic introduced by the Chilean psychoanalyst I. Matte Blanco. We ground our proposal in the original Freudian proposal concerning the distinction between *object* and *wordpresentation*, and we devise a formal logical model of this distinction in order to explaining some structural invariances of the psychoanalytic view of mental processes on one hand and some recent evidenceson the processes of the Default Mode Network on other. Finally, some clinical implications of the model are discussed.

Keywords: Default Mode Network, Freudian psychoanalytic theory, Bi-Logic, Matte Blanco, word presentation, object presentation

Volume 13 Issue 1 - 2022

Giulia Battilotti,[1] Miloš Borozan,[2] Rosapia Lauro Grotto[3]

[1]Department of Neuroscience, Imaging and Clinical Sciences and Center for Advanced Studies and Technologies (C.A.S.T.), UniversitàdegliStudi "G. d'Annunzio" di Chieti-Pescara, Italy

[2]Department of Mathematics, Università degli Studi di Padova, Italy

[3]Department of Health Sciences, UniversitàdegliStudi di Firenze and M.A.R.H.C. (Multidisciplinary Analysis of Relationships in Health Care) Laboratory, Pistoia, Italy

Correspondence: Rosapia Lauro Grotto, Department of Health Sciences, Psychology Section, Via San Salvi 12, 50135 Firenze, Italy, Tel: 00390552755073, Email rosapia.laurogrotto@unifi.it

Received: May 01, 2022 | **Published:** May 09, 2022

Abbreviations: DMN, Default Mode Network; ASD, Autistic Spectrum Syndrome

Introduction

The quest for an understanding of how the changes in our minds are related to the changes in our brains has occupied mankind for more than a century. Today, the techniques of functional neuroimaging represent the basic tools for progress in the field of *human brain mapping*, defined as the visualization of the brain areas and their interconnections engaged in a certain function by using non-invasive techniques.[1,2] These thriving fields of basic and clinical neuroscience are commonly based on the investigative strategy combining experimental designs of experimental (mostly cognitive) psychology and the use of functional brain imaging techniques.[3] One of the most recognizable findings stemming from this research is the serendipitous discovery of a vast functional network of brain regions called Default Mode Network (DMN).[4-6] DMN represents the neural substructure of a multitude of essential mental functions such as self-referential thought processes.[7-9] Integration of the idiosyncratic memories and worldly information[10,11] and so on. Furthermore, anomalies in the DMN functioning have been correlated to pathogenesis of different mental disorders such as schizophrenia,[12-14] Autism Spectrum Disorders (ASD)[15-18] and Major Depressive Disorder.[19-24] However, despite the impressive progresses hitherto made, there is nevertheless a need for a theoretical framework in order to integrate converging empirical findings into a cogent theory, which in turn could support the next wave of hypothesis-driven research into the neural underpinning of mental function. One of the areas that has received most attention regards the possibility of rapprochement of neurosciences and psychoanalytic theories.[25,26] Thus, in this work we would like to propose the idea for a formal framework, based on a logical model derived from quantum cognition[27-29] for the integration of the results from the neuroscience concerning the DMN and the field of psychoanalysis.

The Default Mode Network

In recent research, in order toendow the interested scholars with a theoretical basis for neuroscientific research, cognitive models, predominantly based on the idea of structure-function associations were proposed.[26] Among others, these models precluded the possibility of studying implicit and affective processes (*idem*) and their strict focus quickly became an obstacle to further developments. However, a serendipitous finding emerged nonetheless in the context of a paradigm that was not expecting it, and that did not initially have the conceptual tools with which adequately to interpret it - in 2001, Marcus E. Raichle and colleagues published a paper that introduced the concept of *default mode of brain function* - an organized mode that is present as a baseline or default state and is suspended during specific goal-directed behaviors,[30] underlined by a specific set of neural regions. Two years later, Greicius and colleagues[31] coined the functional-anatomical term *Default Mode Network* (DMN), arguing that it "account[ed], in large part, for the phenomenon of task-related decreases in brain activity"(2003, p. 256). These findings re-introduced the concept of vast neural networks underpinning mental functions into the research on mind-brain connections[26] and contributed to the emergence of the new wave of empirical studies and theoretical considerations capable of containing the results. However, the latter are still problematic and thus scholars have been exploring new interdisciplinary areas of integration to create a suitable conceptual framework.

Psychoanalysis and Neuroscience

As highlighted by Cieri and Esposito[26] in 2019 among others, neuroscience can analyze the physiology of mind in accordance with a psychoanalytic paradigm, following Freud's original project. As is well known, Freud's first attempts to model psychic processes were devised in neurological terms.[32] However, as pointed out, the technology at the time was far from capable of allowing for a meaningful exploration of the neural correlates of mental functions as proposed by Freud so he had to settle for a purely psychological modelization.[26]

However, recent years have seen a renaissance of the idea of pinpointing the neural bases of various elements of psychoanalytic theory.[33,34] The majority of this scholarship is focused on the energy dimension of the theory and using the Free Energy Principle put forward by Freeston and his collaborators[35,36] in 2010 to create a conceptual superstructure capable of linking the two domains of research. For

instance, the activation of DMN has been frequently associated with the mode of the Unconscious,[37] with the *creativity by means of free associations*[38,39]and as a target structure of psychoanalytic and other therapeutic practices.[40-42]

A formal idea encompassing mental and neural processes

Our approach is somewhat different and is based on ideas advanced by Freud, the neurologist, before the birth of the psychoanalytic method. Namely, we consider Freud's study "On Aphasia" of 1891,[43] where he first developed a coherent model of psychic functioning. This psycho-physiological model was based on the construct of mental *representation*, individualized as a building block of our mental life. In this view, psychic functioning is rooted in the vicissitudes of representations of objects (both of our internal as well as external world) and the representation of their verbal correlates, that is, of the words. The two types of representations have peculiar characteristics - representation of objects, i.e.*thing-presentations*, are *open*, while the *word-presentations* are *closed*. Here we find the first intellectual seeds of the psychoanalysis as talking cure[44] - in Freud's view, it is *only* through a link to a word that an object can enter our consciousness. Also, thing-presentation is the necessary assumption to obtain word-presentation, whereas in the case of a rupture of this connection we have a case of aphasia. Therefore, the very essences of the psychoanalytic method was devised as a creation of the conditions to make thing-presentations finally emerge to consciousness through words.

Afterwards, in his First Topics, Freud further elaborated these considerations and proposed the constitutive difference between the Primary Process, which deals with thing-presentations and the Secondary Process which rather concerns word-presentations.[45]

A generation after Freud, a further characterization of the functioning of the mind has been proposed by the Chilean psychoanalyst I. Matte Blanco.[46,47] His aim was to set forward a new epistemological foundation for psychoanalytic theory, based on a development of a *formal* model of mind functioning.[46] Namely, he considers the totality of psychic processes in terms of two logical principles underlying the conscious and unconscious thought. The former is grounded in the classical, Aristotelian logic, while the latter is the realm of the *principle of symmetry* (ibidem). The two principles embody the structural and irreducible differences between the conscious and unconscious processes, mirroring Freud's description of the characteristics of the *structuralUnconscious*[45]: the peculiarities of Unconscious thought are thus positively epitomized by the symmetrization and indivisibility of its elements[46]: Matte Blanco's theory is known as Bi-Logic and is firmly grounded in clinical practice, particularly in his observations of schizophrenic thinking: in such a case, the symmetric mode is apparent because it overflows into consciousness Previously, we have advanced a formalization model of the Bi-Logic theory,[48] based on mathematical-logical notions developed in a context that could be described as computational psychoanalysis.[49,50] In our model, we interpret the infinite, indivisible and symmetric objects of the *Ucs* as *infinite singletons*[27,51] that is, particular sets given without specifying their elements, namely without *words*. This theoretical construction has allowed us to describe the objects of the *Ucs* in an *open* way and therefore to find the correspondence with *thing-presentations*. On the other hand, we describe *word-presentations* as correlates of definite/finite singletons - the *normal* sort of singleton - that is, a set made of a single element, which is definitively described by a corresponding word. While the latter category of elements can be subjected to any common process of information elaboration based on standard logical reasoning, infinite singletons require a *non-standard* logical setting (the Unconscious is nevertheless "the realm of the illogical"[52] that can be proved to correspond to the elements of the Primary Process.[48]

Furthermore, we have shown that infinite singletons can emerge only when mental elaboration takes place *in absence of the external reality*, that is, when the mental content cannot be represented by linking it to an external stimulus. We consider that the characterization of an external stimulus necessarily amounts to the creation of a more *defined* mental object. For, we recognize something as *external* since it differs, is separated, from our internal elements (*idem*) and so it has a different quality that can make it representable not by an infinite but by a finite singleton. Ultimately, it could be characterized by a word of the language, therefore acquiring a *closed*character and becoming mentally processable, unlike the raw and undefined object representations. Moreover, we have advanced a description of the logical features of the process of representation of symmetric, corporeal Unconscious elements via their instantiation through singletons embodying word concepts,[48] a perspective that can be likened to Bion's alpha function theory[53-55] and mentalization theory[56] among others.

In the present attempt, in a context of a dyadic and monist view of the correlation between psychological systems and their neural basis,[26,57] we would like to highlight the structural analogies between the aforementioned logical features of mental processes and the integrative, meaning-based role of the DMN in the interplay of internal and external information. As described by Yeshurun and colleagues[11] in 2021, the DMN seems to be, among else, a central "sense-making" network, entrusted with the difficult task of creating meaningful models for the interpretation of the dynamic changes in external/internal environment. Activation patterns in the DMN can account for the individual differences in interpretation of the surrounding world and its levels of activation are seemingly dependent on the situational coherence and meaningfulness of the experience (idem). These aspects are coherent with the psychoanalytic view in which in our mental space, any representation can stand for or symbolize any other mental content as long as its *meaning* is conserved.[58] Likewise, from the point of view of both the psychoanalytic theories and the scholarship on the DMN, the process of coherentization guided by meaning seems to be the main focus: indeed, our proposal of a formal model based on the notion of the infinite singleton advances a hypothesis that one corresponds to the other. Namely, our model accounts for the structural invariances in the elaboration processes on two levels - the psychological and the neural ones. Summing up, in terms of our formal model, we would like to propose a formal theoretical superstructure based on the idea of structural analogies between the information processing in a psychoanalytic framework and the findings on the integrative role of the DMN.

This theoretical construction entails the possibility of DMN being the neural correlate of the process of instantiation of infinite singletons into the finite ones via the integration of individual idiosyncratic memories and beliefs and the external inputs related to the specific reality situation. Our model draws on a consistent empirical support indicating that the DMN activation is meaning-dependent and that, on the contrary, the DMN does not respond to low-level stimuli and to any change that does not modify their semantics.[10,59-61] Furthermore, there is robust experimental evidence supporting the idea that the DMN is structure responsible for the functional incorporation of the sensory and motor modalities into *word concepts.*[6]. Finally, the quintessential role of consciousness in our mental functioning mirrors well the type of thinking processes that can be associated with the

DMN, that is "…the DMN's functioning concerns its involvement in inner mental processes far from all external stimuli, building dynamic mental simulations…"(p. 6).[26]

We must mention that the idea of correspondence between the DMN functions and the Freudian concept of Secondary Process[63] has been already proposed - for instance, Cieri and Esposito[26] in 2019 advance the hypothesis of the link between the function of *Ego*, as described in Freud's Second Topics,[62] and the DMN, in the aforementioned perspective of Free Energy Principle.[35] Nevertheless, as Matte Blanco pointed out,[47] the *structural* view of the Unconscious proposed in the First Topics is hidden by the successive tripartite view of the Second Topics, with the result that the indispensable function of the Unconscious does not result clear anymore. Here, we would like to stress its role even for the Ego functions and in doing so, we are more in line with the interpretation proposed by Rizzolatti and colleagues in 2014, according to which the DMN should instantiate that part of Ego functions that is responsible for the unconscious Ego processes.[34] Furthermore, this view is coherent with Matte Blanco's statement that mental life is described by a Bi-Logic system always comprising the interplay between the symmetric and the asymmetric functioning of the mind.[48]

Some potential clinical implications

The conceptual interpretation we put forward entails some immediate clinical implications. For instance, as already mentioned, there is empirical evidence on the correlation of Autism and the anomalies in the activation patterns of the DMN.[64] Namely, in the case of Autistic patients, the strength of functional interconnections between different neural constituents of the DMN seem to be insufficient.[65] On the other hand, phenomenological accounts of Autism point out the difficulties in the elaboration of external inputs, as if the person suffering from this condition was overwhelmed by external stimuli.[66] In our view, the underlying problem between these two streams of findings could be represented as a disorder in the process of information *integration*. Subsequently, we can say that this basilar problem unfolds on one hand as a necessity of mental consideration of each stimuli in a singular and sequential fashion, and on the other as a fragility of neural links between the different brain regions of the DMN. Similar reconceptualizations of different mental disorders in formal terms have been proposed by Saad[67] in 2020 and Cieri and Esposito.[26]

Conclusion

By combining the developments of the neuro-physiological research on the DMN with the theoretical advances of the formal model describing infinite singletons, we can go a step forward in integrating psychoanalytic theory with ongoing neuro-scientific evidence. Our model could represent a first step towards an *unsaturated*, coherent theory of mental function, capable of containing the ever-growing wealth of experimental neuroscientific evidence. Furthermore, it could designate a new way of thinking about mental disorders and therefore open new therapeutic avenues, based on a clear conceptualization of the underlying problems. In this way the formal model of infinite singletons would support the intrinsic coherence of neuro-scientific evidence with psychoanalytic theory and clinical practice.

Finally, we would like to mention that a possible future development of our theory is an interpretation in which judgements can be considered as a particular finitization of infinite singletons (Battilotti, Borozan, Lauro Grotto, *in preparation*), that excludes the characterizing elements of the primary process preserving only a form of infinite which can allow abstract thinking (in mathematical terms). On one side, this would account for the peculiar characteristics of high-functioning patients on the Autistic Spectrum. On the other, it would allow for a more accurate description of the psychoanalytic therapeutic approach: in such a hypothesis, the *suspension of judgment*[68] prescribed by the classical psychoanalytic approach actually meets the need to preserve and enforce the DMN processing, since any form for judgment could hurt and prevent from developing these already *dysmature* functions.[69]

Acknowledgments

None.

Conflicts of interest

The authors declared no have conflict interest for the study.

References

1. Raichle ME. *The origins of functional brain imaging in humans*. In: Aminoff MJ, Boller F, Swaab, Editors. *Handbook of Clinical Neurology.* Elsevier. 2009;95:257–268.
2. Camprodon JA, Stern TA. Selecting neuroimaging techniques: a review for the clinician. *The primary care companion for CNS disorders.* 2013;15(4):12f01490.
3. Raichle ME. A Paradigm Shift in Functional Brain Imaging, *Journal of Neuroscience*. 2009b;29(41):12729–12734.
4. Andrews-Hanna JR, Reidler JS, Sepulcre J, Poulin R, Buckner RL. Functional-anatomic fractionation of the brain's default network. *Neuron*. 2010;65:550–562.
5. Buckner RL. The brain's default network: origins and implications for the study of psychosis. *Dialogues in Clinical Neuroscience*. 2013;15(3):351–358.
6. Buckner RL, DiNicola LM. The brain's default network: updated anatomy, physiology and evolving insights. *Nature Reviews Neuroscience.* 2019;20:593–608.
7. Andrews-Hanna JR. The brain's default network and its adaptive role in internal mentation. *Neuroscientist*. 2012;18:251–270.
8. Andrews-Hanna JR, Saxe R, Yarkoni T. Contributions of episodic retrieval and mentalizing to autobiographical thought: evidence from functional neuroimaging, resting-state connectivity, and fMRI meta-analyses. *NeuroImage*. 2014a;91:324–335.
9. Andrews-Hanna JR, Smallwood J, Spreng RN. The default network and self-generated thought: component processes, dynamic control, and clinical relevance. *Annals of the New York Academy of Sciences*. 2014b;1316:29–52.
10. Yeshurun Y, Nguyen M, Hasson U. Amplification of local changes along the timescale processing hierarchy. *Proceedings of the National Academy of Sciences of the United States of America*. 2017;114(35): 9475–9480.
11. Yeshurun Y, Nguyen M, Hasson U. The default mode network: where the idiosyncratic self meets the shared social world. *Nature Reviews Neuroscience*. 2021;22:181–192.
12. Woodward ND, Rogers B, Heckers S. Functional resting-state networks are differentially affected in schizophrenia. *Schizophrenia research*. 2011;130(1-3):86–93.
13. Tang J, Liao Y, Song M, Gao JH, Zhou B, et al. Aberrant default mode functional connectivity in early onset schizophrenia. *PloS one*. 2013;8(7):e71061.
14. Yang Z, Wu J, Xu L, Deng Z, Tang Y, et al. Individualized psychiatric imaging based on inter-subject neural synchronization in movie watching. *Neuro Image*. 2020;216:116227.

15. Jung M, Kosaka H, Saito DN, Makoto Ishitobi M, Morita T, et al. Default mode network in young male adults with autism spectrum disorder: relationship with autism spectrum traits. *Molecular Autism*. 2014;5:35.

16. Yerys BE, Gordon EM, Abrams DN, Satterthwaite TD, Weinblatt R, et al. Default mode network segregation and social deficits in autism spectrum disorder: Evidence from non-medicated children DMN in children with ASD. *NeuroImage: Clinical*. 2015;9:223–232.

17. Padmanabhan A, Lynch CJ, Schaer M, Menon V. The Default Mode Network in Autism. Biological psychiatry. *Cognitive neuroscience and neuroimaging*. 2017;2(6):476–486.

18. Nair A, Jolliffe M, Lograsso YSS, Bearden CE. A Review of Default Mode Network Connectivity and Its Association With Social Cognition in Adolescents With Autism Spectrum Disorder and Early-Onset Psychosis, *Frontiers in Psychiatry*. 2020;11.

19. Guo CC, Nguyen VT, Hyett MP, Parker GB, Breakspear MJ. Out-of-sync: disrupted neural activity in emotional circuitry during film viewing in melancholic depression. *Scientific Reports*. 2015;5.

20. Hamilton JP, Farmer M, Fogelman P, Gotlib IH. Depressive Rumination, the Default-Mode Network, and the Dark Matter of Clinical Neuroscience. *Biological psychiatry*. 2015;78(4):224–230.

21. Coutinho JF, Fernandesl SV, Soares JM, Maia L, Gonçalves ÓF, et al. Default mode network dissociation in depressive and anxiety states. *Brain imaging and behavior*. 2016;10(1):147–157.

22. Wise T, Marwood L, Perkins A, Herane-Vives A, Joules R, et al. Instability of default mode network connectivity in major depression: a two-sample confirmation study. *Translational Psychiatry*. 2017;7:e1105.

23. Yang Z, Wu J, Xu L, Deng Z, Tang Y, et al. Individualized psychiatric imaging based on inter-subject neural synchronization in movie watching. *Neuro Image*, 2020;216:116227.

24. Gruskin DC, Rosenberg MD, Holmes AJ. Relationships between depressive symptoms and brain responses during emotional movie viewing emerge in adolescence. *Neuro Image*. 2020;216.

25. Rizzolatti G, Semi GAA, Fabbri-Destro M. Linking psychoanalysis with neuroscience: The concept of ego. *Neuropsychologia*. 2014;55:143–148.

26. Cieri F, Esposito R. Psychoanalysis and Neuroscience: The Bridge Between Mind and Brain. *Frontiers in Psychology.* 2019;10.

27. Battilotti G. Quantum States as Virtual Singletons: Converting Duality into Symmetry. *International Journal of Theoretical Physics*. 2014a;53:3488–3502.

28. Busemeyer JR, Wang Z. What is quantum cognition, and how is it applied to psychology? *Current Directions in Psychological Science*. 2015;24(3):163–169.

29. Bruza PD, Wang Z, Busemeyer JR. Quantum cognition: a new theoretical approach to psychology. *Trends in cognitive sciences*. 2015;19(7):383–393.

30. Gusnard DA, Raichele ME. Searching for a baseline: functional imaging and the resting human brain. Nature Review Neurosciences. 2001;2:685-694.

31. Greicius MD, Krasnow B, Reiss AL, Menon V. Functional connectivity in the resting brain: a network analysis of the default mode hypothesis. *Proceedings of the National Academy of Sciences of the United States of America*. 2003;100(1):253–258.

32. Freud S. *Project for a scientific psychology*, SE 1. 1895;281–391.

33. Carhart-Harris RL, Mayberg HS, Malizia AL, Nutt D. Mourning and melancholia revisited: correspondences between principles of Freudian metapsychology and empirical findings in neuropsychiatry. *Annals of General Psychiatry*. 2008;7:9.

34. Rizzolatti G, Semi GAA, Fabbri-Destro M. Linking psychoanalysis with neuroscience: The concept of ego. *Neuropsychologia*. 2014;55:143–148.

35. Friston K. The free-energy principle: a unified brain theory? *Nature Reviews Neuroscience*. 2010;11:127–138.

36. Carhart-Harris RL, Friston KJ. The default-mode, ego-functions and free-energy: a neurobiological account of Freudian ideas. *Brain*. 2010;133(4):1265–1283.

37. Zellner MR. Dreaming and the Default Mode Network. *Contemporary Psychoanalysis*. 2013;49(2):226–232.

38. Marron TR, Lerner Y, Berant E, Kinreich S, Shapira-Lichter I, et al. Chain free association, creativity, and the default mode network. *Neuropsychologia*. 2018;118(Pt A):40–58.

39. Marron TR, Berant E, Axelrod V, Faust M. Spontaneous cognition and its relationship to human creativity: A functional connectivity study involving a chain free association task. *NeuroImage*. 2020;220.

40. Buchheim A, Labek K, Walter S, Viviani R. A clinical case study of a psychoanalytic psychotherapy monitored with functional neuroimaging. *Frontiers in human neuroscience*. 2013;7:677.

41. Simon R, Engström M. The default mode network as a biomarker for monitoring the therapeutic effects of meditation. *Frontiers in Psychology*. 2015;6.

42. Lauro Grotto R, Borozan M. Is the default mode network a target neurophysiological substrate of psyhodynamic psychotherapy? *Mediterranean Journal of Clinical Psychology*. 2016;4(2):37.

43. Freud S. *On aphasia: A critical study.* New York: International Universities. 2002.

44. Finelli R. Rappresentazione e linguaggio in Freud: a partire dal 'Compendio di psicoanalisi', *Consecutio temporum*, 1, www.consecutiotemporum.it. 2011;113.

45. Freud S. *The interpretation of dreams*. SE 4. 1900.

46. Matte Blanco I. *Thinking, feeling, and being: clinical reflections on the fundamental antinomy of human beings and world.* London, Routledge. 1988;298.

47. Matte Blanco I. Comments on 'From Symmetry to Asymmetry' by Kluas Fink. *International Journal of Psychoanalysis*. 1989;70:491–498.

48. Battilotti G, Borozan M, Lauro Grotto R. Infinite Singletons and the Logic of Freudian Theory. *Language and Psychoanalysis*. 2021;10(2):46–62.

49. Iurato G. *Computational Psychoanalysis and Formal Bi-Logic Frameworks*, IGI Global, ISBN: 1522541284. 2018;332.

50. Iurato G, Khrennikov A, Murtagh F. Formal foundations for the origins of human consciousness. *p-Adic Numbers, Ultrametric Analysis and Applications*. 2016;8:249–279.

51. Battilotti G. Symmetry vs. Duality in Logic: An Interpretation of Bi-Logic to Model Cognitive Processes Beyond Inference. *International Journal of Cognitive Informatics and Natural Intelligence (IJCINI).* 2014b;8(4).

52. Freud S. *An outline of psychoanalysis*, SE 23. 1938;141–207.

53. Bion WR. Attacks on linking, in *Melanie Klein today: Developments in theory and practice. Volume 1: Mainly theory* (Ed. by E. Bott Spillius), London: Routledge. 1959.

54. Bion WR. A theory of thinking. *International Journal of Psychoanalysis*. 1962a;43:178–186.

55. Bion WR. *Learning from experience*. London: Heinemann. 1962b.

56. Fonagy P, Allison E. What is mentalization? The concept and its foundations in developmental research. In N. Midgley & I. Vrouva (Eds.), *Minding the child: Mentalization-based interventions with children, young people and their families*. Routledge/Taylor & Francis Group. 2012;11–34.

57. Solms M. The hard problem of consciousness and the free energy principle. *Frontiers in Psychology*. 2019;9(2714).

58. Lauro Grotto R. The Unconscious as an ultrametric set. *American Imago.* 2008;(644):52-62.

59. Baldassano C, Chen J, Zadbood A, Pillow JW, Hasson U, et al. Discovering Event Structure in Continuous Narrative Perception and Memory. *Neuron*, 2017;95(3):709–721.e5.

60. Tikka P, Kauttonen J, Hlushchuk Y. Narrative comprehension beyond language: Common brain networks activated by a movie and its script. *PloS one*. 2018;13(7):e0200134.

61. Wilson SM, Bautista A, McCarron A. Convergence of spoken and written language processing in the superior temporal sulcus. *Neuro Image.* 2018;171:62–74.

62. Fernandino L, Binder JR, Desai RH, Pendl SL, Humphries CJ, et al. Concept Representation Reflects Multimodal Abstraction: A Framework for Embodied Semantics. *Cerebralcortex*. 2016;26(5):2018–2034.

63. Freud S. *The ego and the Id*, SE 19. 1923;1–66.

64. Murdaugh DL, Shinkareva SV, Deshpande HR, Wang J, Pennick MR, Kana RK. Differential deactivation during mentalizing and classification of autism based on default mode network connectivity. *PloS one*. 2012;7(11):e50064.

65. Washington SD, Gordon EM, Brar J, Warburton S, Sawyer AT, et al. Dysmaturation of the default mode network in autism. *Human brain mapping*. 2014;35(4):1284–1296.

66. Boldsen S. Toward a Phenomenological Account of Embodied Subjectivity in Autism. *Culture, medicine and psychiatry*. 2018;42(4):893–913.

67. Saad A. On the logic of the unconscious. *The International Journal of Psychoanalysis*. 2020;101(2):239–256.

68. Balsamo M. *Libere associazioni?* Milano, Franco Angeli. 2011.

69. Washington SD, Gordon EM, Brar J, Warburton S, Sawyer AT, et al. Dysmaturation of the default mode network in autism. *Human brain mapping*. 2014;35(4):1284–1296.

Citation: Battilotti G, Borozan M, Grotto RL. Infinite Singletons and the Default Mode Network. *J Psychol Clin Psychiatry.* 2022;13(2):9–13. DOI: 10.15406/jpcpy.2022.13.00706